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ministrative district to insure to France the exploitation of the mines. In 1935 or 15 years after the ratification of the Treaty of Versailles, and after a plebiscite of the inhabitants has been held, the League of Nations is to decide whether the Saar District is to be allotted to France or to Germany or to remain under League governance. If it is returned to Germany, the latter may purchase the coal mines from France at a price determined by a committee of three, consisting of a neutral member, a Frenchman and a German. Coal production in the Saar in 1929 reached 13,579,348 metric tons. Both mines and customs are run independently of the commission by two local directors. SAARBRÜCKEN, pop. 1925, 125,020, is the principal city. Pop. 1927, 770,030.

SABAEAN, an extinct SEMITIC language of the South ARABIC group preserved in a number of inscriptions from Sirvah and Mahrib. Its alphabet consists of 29 consonants written from right to left; and except for a suffixed article, as in ARAMAIC, its grammar differs little from Arabic.

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SABAS, ST. (439-531), hermit of Palestine and founder of Great Laura Monastery, was born near Caesaria, Cappadocia, about 439. He lived as a monk and hermit near Jerusalem and then founded the Great Laura Monastery, now known as the Monastery of Mar Saba. He adhered to the Rule of St. Basil and espoused the orthodox position in the Eutychian Heresy. St. Sabas died in his monastery about 531. His day is celebrated on Dec. 5.

SABATIER, PAUL (1854-), French chemist, was born at Carcassonne, March 5, 1854. Since 1882 he is professor and dean of the faculty of science at the University of Toulouse. Sabatier received many academic honors, shared in 1912 the Nobel Prize for chemistry with V. GRIGNARD and is honorary member of various learned societies. His *Catalyse en Chimie* interprets his researches.

SABATINI, RAFAEL (1875-), Italian author, was born at Jesi, Central Italy, in 1875. He was educated in Switzerland and Portugal, and later lived in England. He became famous for his swift-moving, historical romances and tales of adventure, several of which have been successfully dramatized. Sabatini's published works include *The Tavern Knight*, *Bardelys*, *the Magnificent*, *Anthony Wilding*, *The Life of Cesare Borgia*, *Torquenada and the Spanish Inquisition*, *The Gates of Doom*, *The Sea Hawk*, *The Snare*, *The Historical Nights Entertainment*, *Scaramouche*, *Captain Blood*, *The Hounds of God*, and *The Black Swan* (1932).

SABBATH, the Jewish day of rest, the seventh day of the week, or Saturday, observed as holy and as a day of solemn rest and joyous observance. Christians observe Sunday as the Sabbath, and Mohammedans, Friday. Despite its weekly occurrence, the Sabbath is of greater importance than any of the Jewish festivals or fast days. Like all the days of the Jewish calendar, the Sabbath begins at sundown

on Friday evening and ends at sundown on Saturday evening. It has been observed by the Jews ever since the days of Moses, when it was enjoined upon the Hebrew people.

The chief Biblical basis for the Sabbath is found in Genesis 2:1-3; Leviticus 23:2-3. In the former passage the reason for the observance of the Sabbath is that God made the world in six days, and rested on the seventh day, thereby consecrating it and making it holy, and to be observed by the Hebrews for all time. In the latter passage no ostensible reason is advanced for the observance of the Sabbath. On the Sabbath all work was prohibited, both in the field and in the home; animals were to be given a day of rest each week, as were men and servants. Fires were not to be lighted on the day, and the usual weekday tasks and occupations were to be omitted. The day was to be spent in holy convocation or, as in later times, in the house of prayer and study, or as a solemn rest. The rabbis and teachers of the Law, in the later period, safeguarded the integrity and holiness of the Sabbath by means of a multitude of legal regulations designed to prohibit any act which might, however remotely, lead to a violation of the Sabbath. In addition, the law regarding the observance of the Sabbath represents the fourth of the TEN COMMANDMENTS. It is found both in Exodus 20:8-11 and in Deuteronomy 5:12-15. In the former passage the reason given for its observance is that God made heaven, earth, sea and the whole of the physical universe in six days, and rested on the seventh day; in the latter, it is stated, somewhat irrelevantly, that the seventh day is a Sabbath to God because Israel was a servant in the land of Egypt and God delivered him from bondage.

During the medieval period the Sabbath among the Jews was observed as the great festival of joy and celebration. Special Sabbath clothes were worn by men, women and children; the table was specially adorned with the best of foods and the whitest of linen in honor of the Sabbath. The Sabbath candles were lighted by the housewife, the Sabbath loaves (called Hallah, a reminiscence of the shew-breads of the ancient Temple at Jerusalem) were placed upon the table and the blessing over them and the wine (Kiddush) recited by the master of the house. In the synagogue and in the home special hymns were sung as a greeting to the Sabbath, which was allegorically conceived of as the bride, the inseparable companion of Israel. Most of these observances are still practiced to-day in tens of thousands of Jewish homes and synagogues in all parts of the world.

Jesus and his disciples themselves kept the seventh day of the week as the Sabbath; during the 2nd century two Sabbaths were kept, Saturday and Sunday. However, in 321, under Constantine the Great, the first Sunday law was enacted, which subsequently had as its direct effect the abolition of the Jewish Sabbath as an observance of the Church. This was a movement which had been going on for some time within the Christian Church for the purpose of sub-

stituting for Saturday the day of the resurrection. It is interesting to note, in this connection, that the modern Seventh Day Adventists have reverted to the Jewish Sabbath as the authentic day of rest. A. SH.

See Morris Joseph, *Judaism as Creed and Life*, 1922.

SABELLIANS, a heresy of the 4th century, which declared that the Three Persons in the one God are in effect indistinguishable. See **ARIANISM**.

SABER, a slightly curved sword used by mounted troops. The cavalry saber has changed gradually from a curved form for cutting and thrusting to a straight thrusting blade.

SABICU WOOD, an exceedingly heavy, hard, close-grained wood valued for ship building and other purposes where great durability is required. It is produced by a large tree (*Lysiloma Sabicu*) of the mimosa tribe of the pea family, native to Cuba. The tree bears stout spreading branches, leaves divided into numerous paired leaflets, minute greenish-white flowers in globular heads and broad, flat, many-seeded pods.

SABIN, FLORENCE RENA (1871-), scientist and anatomist, specialist in lymphatics, was born in Central City, Colorado, Nov. 9, 1871. In 1893 she graduated from Smith College and was one of the first women to receive the degree of M.D. from Johns Hopkins (1900). In 1924 she was made a member of the National Academy of Sciences in recognition of her work on blood vessels and red corpuscles, and in 1925 was the first woman to be appointed a full member of the Rockefeller Institute for Medical Research.

SABINE RIVER, a river of eastern Texas, formed in the northeast portion of the state by several streams rising in Collin and Hunt counties. This river flows southeast to the eastern border of the state from which point it runs southward, forming the boundary line between Texas and Louisiana, and empties into the Gulf of Mexico through Sabine Lake and Sabine Pass. Its length is estimated at 400 mi. The Pass has been opened by dredging and jetty building so that small steamboats can enter and ascend the river for some distance. The cities of Orange and Port Arthur, Tex. are situated near its mouth. The Sabine has figured prominently in history as a disputed boundary line between claimed territories of the United States and Mexico.

SABINI, an ancient people of central Italy. Although they are believed to have participated, with the Latins, in the founding of Rome, with their center on the Quirinal, yet some of them were struggling, centuries later, against the growing power of that city; in 449 B.C. they were severely beaten, and in 290 B.C. incorporated as non-voting citizens of the Roman state. They had no further history. Several Roman institutions, especially the patrician class, and the solemn marriage available to them alone, and some great patrician families, notably the Claudian, claimed the Sabine origin.

SABLE (*Mustela zibellina*), a small fur-bearing animal allied to the **MARTEN**, found only in Siberia. Its

habits are those of the marten but it is found further north than martens usually range, living in primeval forests known only to the fur-hunter. It is due to the hunters of sable that eastern Siberia was first explored. Inch for inch, sable is most valuable of all fur, and the best dark skins, known as imperial sable, were once reserved for the czar's family. The fur is soft, silken and so dense that it can hardly be blown open, turning in every direction and never having a slicked appearance. It is brown in color, shading almost to black, the tips of the shoulder hairs sometimes being slightly silvered. The so-called Canadian sable is really a marten. Attempts to breed the true sable on fur farms in the northern United States and Canada have met with little success.

SABOTAGE, all practices designed to harass and injure an employer, by impeding production, wrecking machinery, and making private or capitalist undertakings unprofitable. In the United States it was advocated by the **INDUSTRIAL WORKERS OF THE WORLD** and has been penalized by state legislation. In Soviet Russia it has been given a wide sense, to include any deliberate obstruction or impairment of Communist production, including, apparently, acts of heedlessness and inefficiency, and may be punishable by death.

The term is derived from the sabot or wooden shoe of the workman, dropped into machinery to stop or injure the mechanism.

SABRE-TOOTHED TIGER. See **SMILODON**.

SACAJAWEA or **SACAGAWEA** (c. 1788-1884), American Shoshone Indian guide, was born about 1788. Captured in childhood by the Minetaree Indians she was sold to a Frenchman named Charboneau, whom she married. In 1804 she and her husband are known to history as the guides of the Lewis and Clark expedition. With great courage she led the band of explorers through the uncharted wilderness. She returned with the expedition in 1806 to the Minetaree country, and died at the Shoshone agency in Wyoming, Apr. 9, 1884. Statues of Sacajawea have been erected in Oregon, North Dakota, and Wyoming.

SACCHARIN, a sweet, non-carbohydrate, in the form of a white crystalline powder about 500 times as sweet as sugar. Chemically it is an orthobenzoic sulphinid, prepared from sulphonated toluene. It melts at 220° C. with decomposition. It is soluble in water and forms a sodium salt, which is used as sweetening agent, especially for diabetics. It possesses no food value, but is harmless in quantities greater than an equivalent amount of sugar.

SACCHAROSE. See **CARBOHYDRATES**.

SACHS, HANS (1494-1576), German meistersinger, was born at Nuremberg, Nov. 5, 1494. Apprenticed to a shoemaker, he started to study at the age of 19 and thereafter divided his attention between shoemaking and poetry. As journeyman-apprentice he traveled from city to city in Germany, eagerly drinking in knowledge and experience. From 1515 until his death he lived in Nuremberg. Sachs's dra-

matic writings preach temperance in all things, and his humor is without a trace of bitterness. He possessed an unusually extensive vocabulary and his plays contain a wide range of learned allusions. His 200 plays are naïve and the characters of his historical romances are all animated Nurembergers of his period. In one comedy called *Unlike Children of Eve*, God supposedly makes a call in Adam's house and speaks like a typical Nuremberg clergyman. The comedies are chiefly slender farces whose sources can be traced to ancient history and medieval legend. Sachs died obscurely Jan. 19, 1576.

SACHS, JULIUS VON (1832-97), German botanist, was born at Breslau, Oct. 2, 1832. From 1851 to 1859 he studied and taught botany at the University of Prague. Then he became assistant in plant physiology at the Academy of Agriculture, Tharandt, Saxony. In 1861 he held a similar position at Poppeisdorf, six years later he became professor of botany at Freiburg, Breisgau, and in 1868 professor of botany at Wurzburg. Sachs was particularly distinguished for his studies of the physiology of plant growth germination, and nutrition, and for his application of microscopic chemical methods of analysis to these matters. He worked likewise upon geotropism, heliotropism and rhythm of growth and advanced the theory of inhibition to account for cell growth and pattern. His principal work, *Lehrbuch der Botanik*, 1868, thoroughly covered botany as then known. Sachs died at Wurzburg, May 29, 1897.

SACKVILLE, THOMAS (1536-1608), English statesman and poet, was born at Buckhurst, Sussex, in 1536. He graduated from Cambridge, studied law, and sat in Queen Elizabeth's first two Parliaments. In 1566 he was created Lord Buckhurst, and the Queen sent him on various diplomatic missions. He negotiated for her marriage with the Duke of Anjou. Her displeasure was incurred, however, when he opposed the action of Leicester in the Netherlands. After Leicester's death Sackville was restored to favor, and became Lord High Treasurer, an office in which James I confirmed him for life, creating him Earl of Dorset. The sentence of death was conveyed by him to Essex, and to Mary, Queen of Scots. Sackville was coauthor with Thomas Norton of *Gorboduc*, the first English tragedy in blank verse, performed before the Queen in 1561. His best known work is the beautiful *Induction*, a foreword to *The Mirror for Magistrates*. Sackville died at London, Apr. 19, 1608.

See *Works of Thomas Sackville*, ed. by R. Sackville-West, 1859.

SACO, a city in York Co., southwestern Maine, situated on the Saco River near the coast, 14 mi. southwest of Portland. Bus lines and the Boston and Maine Railroad afford transportation. Saco is in a farming region. Abundant hydro-electric power is supplied by the river for the chief local industry, cotton-milling. Several trans-Atlantic flights have started from the beach of Old Orchard, near by. The site of Saco was settled in 1630. Saco and Biddeford were

one town until Saco was set off and incorporated as Pepperellboro in 1762. In 1805 it was again called Saco, being chartered as a city in 1867. Pop. 1920, 6,817; 1930, 7,233.

SACRAMENT, an ecclesiastical term, meaning a solemn rite and derived from the Latin *sacramentum*, which signified the oath of a Roman soldier. The Roman Catholic and Greek Orthodox churches recognize seven sacraments, namely, baptism, confirmation, the eucharist (or Lord's Supper), penance, holy orders, matrimony and, with variations, extreme unction. (See articles under these heads.) The Catholic faith, in east and west, emphasizes strongly the efficiency of sacraments. In the Anglican Prayer Book a sacrament is defined as "an outward and visible sign of an inward and spiritual grace." In most Protestant churches Baptism and the Lord's Supper are administered, though usually in a symbolic sense and not, as a rule, with Catholic ceremonial. The Society of Friends administers no sacraments in the material sense.

SACRAMENTO, the capital of California and the county seat of Sacramento Co., situated in the north central part of the state, on the Sacramento River, about 80 mi. northeast of San Francisco. The Southern Pacific, the Western Pacific and the Santa Fe railways, steamboats, bus and truck lines and several airports serve the city. Sacramento is located in an almost semi-tropical, fertile valley producing spinach, pears, celery and tomatoes. The manufacturing plants include railroad shops and fruit and vegetable canneries. In 1929 the value of manufactured products was about \$50,000,000; the retail trade amounted to \$73,006,726. Among the important buildings are the state capitol and the Crocker Art Gallery. Sacramento has been the home of Bret Harte and Mark Twain, who describe the city in their writings. The city has an extensive park system, some of the most important parks being Capitol Park, Del Paso Park and William Land Park.

In 1839 John Augustus Sutter, a Swiss-born American, built a fort, first called New Helvetia and later Sutter Fort, on the site of Sacramento. Sutter Fort has been restored and is maintained as a state museum of relics of pioneer days in California. Gold was discovered in the vicinity in 1848, leading to the gold rush of '49 and great prosperity. In 1850 Sacramento was incorporated and in 1894 received a new city charter. Pop. 1920, 65,908; 1930, 93,750.

SACRAMENTO RIVER, the largest river of California, rising in the northern part of the state. Its principal headstream, the Pitt River, is an outlet of Goose Lake situated in the extreme northeast corner of California. The Pitt flows southwest until it reaches the great depression between the Sierra Nevada and Coast ranges, and in Shasta Co. forms the Sacramento which flows southward. The latter empties into Suisun Bay on the boundary between Solano and Contra Costa counties. Its length, including the Pitt, is 400 mi. and it has a fall of 7,000 ft. mostly in the upper course. The descent of the lower course is

slight and below the city of Sacramento the river meanders through great tule marshes. Alluvial deposits from placer mines have raised its course above the adjacent county, making it necessary to build levees to protect the country when the river is in flood. Part of Sacramento requires this protection.

The river drains the western slope of the Sierras through its tributaries the American, Feather, Yuba, Bear and smaller streams; and the east slope of the Coast range through Stoney, Cache and Puta creeks. Its drainage basin, covering 28,000 sq. mi., produces large crops of fruit, grain and alfalfa. The Orland irrigation project on Stoney Creek, consisting of the East Park Dam and Reservoir, serves 20,000 acres of the basin. The river is navigable for 180 mi. and transports 1,000,000 tons of freight annually.

SACRARIUM, a place for keeping holy objects, thus a SHRINE, sanctuary or chapel in general; in a specific sense, a niche or cavity in a church for the waste of consecrated substances, such as baptismal water, oil and the like.

SACRED HEART OF JESUS, SOCIETY OF THE, a religious institute of women engaged in educational work. It was begun in Paris, 1800, under the direction of Father Joseph Varin, by St. Madeleine-Sophie Barat and a few companions called at first Dames de la Foi; the following year, their first convent was opened at Amiens. Under a rule based on that of the Jesuits, the society was approved by Leo XII in 1826. Although political and religious upheavals since 1848 have taken their toll, especially in France where 47 houses were closed, 1903-09, new foundations have extended the society throughout the world. A total of 153 houses includes colleges, boarding- and day-schools, and parochial elementary and secondary schools. The number of religious is 6,750. The superior-general resides at Rome.

SACRIFICE, a religious ceremony often performed by primitive peoples at which they destroy something, often but not always a living creature, with the idea that, thus sent away from the material world, it will form a means of communication between themselves and the supernatural. A sacrifice may be leaves or cakes, as on some occasions among the Aztec or the ancient Romans. More frequently it is an animal, chosen for its perfection and possibly of a breed dedicated to a god. The Aztec and other primitive peoples also sacrificed human beings, generally decorating them elaborately and doing all that was possible beforehand to put them in an exalted frame of mind that their arrival might be pleasing to the supernatural powers.

A sacrifice may be performed annually or only on important occasions, such as purification, the harvest or the laying of a foundation. Or there may be a continual round of sacrifice as in ancient Mexico where every day in the year had its appointed offering. There are usually elaborate ceremonies connected with sacrifice, such as purification of the victim, the priest and the spectators and disposal of the remains. *See* RITUAL.

SACRISTAN, one who has charge of a church with special reference to the sacristy and its contents, prepares the altars personally or through assistants, and rings the bell. In cathedrals and other important churches the sacristan is a priest with lay assistants. The sacristan of the Vatican is always an Augustinian friar, a titular bishop and *ex officio* assistant at the throne. The term, therefore, like that of **SEXTON**, is elastic and embraces functionaries ranking from a janitor to a prelate.

SADDUCEES, the name of a party in the last centuries of the Jewish state, best known for its contrast with the Pharisees. The immediate authorities are Josephus and the New Testament (Gospel, Acts); the traditions in the Talmud and Jewish documents are scanty and indirect. The origin of the name is much disputed; it is most reasonably to be connected with the Sons of Zadok (Sadok), who appear in Ezekiel 40:46, etc., as alone entitled to function as high priests. They appear to have been the party of the priesthood, hence aristocratic in politics and conservative in religion, maintainers of the *status quo*, in opposition to the Pharisees, who represented the popular piety and were the party of advance in accommodating the law to modern conditions. The high priests had been the rulers of the Jewish church-state since the restoration under the Persian empire; the Maccabean or Hasmonaean family had arrogated to itself the high priesthood and maintained the double rôle of sacred and civil authority until the Romans dispossessed them of the latter; and the Pharisees arose as a reform party in the bitter struggle against the secularism of the Hasmonaean tyranny in the time of John Hyrcanus and his successors.

The Sadducees as they appear in the first century, although shorn of their political power, were the party that maintained the principle of the privilege of the priesthood (Acts 4:1; 5:17), and so inherited the conflict with the Pharisees, who as the favored teachers of the people were usurping their hereditary authority. They opposed the Pharisaic principle of law; as conservatives they stood often for the harsher and more ancient interpretations. Similarly in theology they refused the later developments of Jewish thought, and so denied the late doctrines of the Pharisees in regard to resurrection, angels, etc. (Matthew 22:23; Acts 23:6 ff.); according to Josephus they believed in the individual's sole responsibility for his fate as against the predestinarianism of the Pharisees. Paul boasts of his Pharisaism (Philippians 3:5), and Josephus was a Pharisee by choice. As essentially an aristocratic party of privilege and with no programme for the future, the Sadducees disappeared with the destruction of the Jewish state.

J. A. M.

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SADLER, SIR MICHAEL ERNEST (1861-), English educator, was born at Barnsley, July 3, 1861. He was educated at Rugby and at Trinity College,

Oxford. A member of the Royal Commission on Secondary Education in 1893-95, he also directed special inquiries and reports in the Education Department, until 1903 when he was called to Victoria University of Manchester. He occupied the chair of history and education at Victoria University until 1911 when he was called to Leeds University as vice chancellor. In 1923 he was elected master of University College, Oxford. His publications include *Continuation Schools in England and Elsewhere*; *Moral Instruction and Training*; and *Our Public Elementary Schools*.

SAFES, or **SAFETY BOXES** probably date from the invention of locks by the Egyptians. The modern fire proof safe dates from the early part of the 19th century, and consisted, as now, of iron or steel sides, top, bottom and door, built double and filled with fire-proof material. The earliest examples had cumbersome locks and keys, but with the invention of the combination tumbler lock, the construction of safes took a new start. The plates were made first of very hard steel, but later of laminated steel plates, which resisted the use of drills. No metallic safe can, however, be built which will withstand the action of the oxy-acetylene flame, or the electric arc—though copper is highly resistant to the action of high temperatures. Large modern safes and vaults are generally equipped with "time locks."

SAFETY ENGINEERING. See ACCIDENT PREVENTION.

SAFETY FIRST. See ACCIDENT PREVENTION.

SAFETY GLASS, a laminated non-shatterable glass with high resistance to penetration or breaking. In thin aggregates about a quarter of an inch thick, it is used in wind shields and automobile windows. Thicker aggregates up to two inches are used as safety glass for bank windows and armored cars, and for port holes in steamships. A steel nosed rifle bullet fired from a machine gun will not pierce laminated glass one inch thick. The safety factor resulting from this invention is incalculable.

Safety glass is made by cementing sheet upon sheet of WINDOW GLASS or PLATE GLASS with a transparent plastic material which looks like celluloid. The transparent cement holds the sheets or plates together in what is known as laminated glass. Pressure is applied to the plates or sheets after the soft cementing layer is placed between, and the entire mass is allowed to set firmly.

The transparent cement holds the adjacent layers firmly so that when a blow is struck, the glass cracks and adheres, instead of shattering and flying. A. S.

SAFETY LAMP, in coal mining, a specially constructed lamp with a protecting envelope around the flame which prevents combustible gases near it becoming heated to the temperature of ignition. Because of the danger from gas or dust explosions in coal mines, such precautions are vital. The first type, the Davy Lamp, had a gauze cylinder around the flame which conducted the heat away rapidly and thus prevented ignition of gases outside the gauze. Modern

types use single and double glass chimneys, with the air inlet well below the flame. The Koehler lamp differs from other safety lamps in that the air is admitted through gauge ports below the flame level. It burns naphtha or benzene and has a flat wick.

Electric safety lamps consist of a storage battery (see STORAGE CELL) and an INCANDESCENT LAMP, the latter being in a reflector connected to the battery by a flexible cord. The bulb socket is provided with a spring which breaks contact with the battery in the event the bulb is broken.

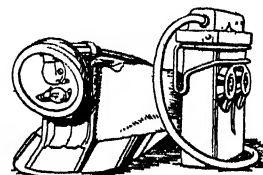
See MINING, COAL.

SAFETY VALVE, a device used on steam BOILERS and other high-pressure containers to relieve the pressure when it reaches a dangerous point. The safety valve comprises a lifting VALVE which is held to its seat by a compression spring or by a LEVER of the second order having a weight attached near its free end. When the pressure against the face of the valve reaches that for which the valve is adjusted, the valve is lifted and held open until the pressure has been reduced to the proper point. For a boiler, the area of the safety valve is usually calculated on the basis of the grate surface, one square inch of valve area to two square feet of grate surface being required for steam vessels by government regulation. In all cases the valve should be large enough to permit the release of pressure as fast as it can be developed in the boiler.

SAFFARIDS, DYNASTY OF, a Persian dynasty founded in the ninth century by an outlaw leader, Yakub, who became governor of Sejestan. After 900 the power of the dynasty was merely accessory to that of the SAMANIDS. The dynasty continued to rule in Sejestan in a subordinate capacity until conquered by the Mongols early in the 13th century. The last of the dynasty was Taj ud-din Binaltagin, 1225-29. See also PERSIA.

SAFFLOWER (*Carthamus tinctorius*), a spiny annual of the composite family allied to the thistles, extensively cultivated for its flowers used in dyeing and for its seeds which yield a useful oil. The plant, no longer known in the wild state, is believed to have been a native of western Asia. In Egypt and in India the safflower has been cultivated for thousands of years. Fabrics wrapped about mummies found in ancient Egyptian tombs are dyed with carthamine, the coloring principle of the safflower. Although largely supplanted by coal tar colors, safflower is still extensively grown in India and China as a red dye for cotton and silk. The dyestuff is extracted from the orange-colored flowers, which are borne in large heads. When mixed with finely powdered talc, it forms the cosmetic known as rouge.

SAFFRON, a deep orange-colored substance obtained from certain flower parts (dried stigmas and



COURTESY WESTINGHOUSE LIGHTING INST.

MINER'S CAP WITH ELECTRIC SAFETY LAMP

style) of the autumn-blooming or saffron Crocus (*C. sativus*). The plant, a native of Asia Minor, has been cultivated since very ancient times, especially in Persia, Cilicia, Greece and Italy. Though saffron was used by the ancients chiefly as a dye, the Greeks scattered it as a perfume in halls and theaters as did the Romans in their baths. When Nero made his entry into Rome, the streets were strewn with saffron. Saffron is now grown mainly in Spain, Persia and Kashmir and is used to color confectionery, liquors, medicines and varnishes and also in cookery.

SAFFRON WALDEN, a market town of Essex, England, well-situated in the hill-enclosed valley of the Cam, about 43 mi. northeast of London. A quiet old-world town, it was an early British stronghold, and earthworks and a Saxon burial ground have been discovered. There are a ruined 12th century castle; the beautiful Perpendicular St. Mary's Church; and fragments of a 12th century Benedictine priory incorporated since 1603 in the splendid mansion, Audley End. The once flourishing Saffron declined in importance in the middle of the 18th century, although some brewing and malting are still carried on. Pop. 1921, 5,874; 1931, 5,930.

SAFRANINES, a class of synthetic dyestuffs, belonging to the group of the basic azines to which also belong the nigrosines and aniline black. They derive their name from the fact that one of them occurs as a constituent of saffron, the yellow natural dye derived from the flowers of the saffron crocus, and very highly prized in ancient times. Chemically the safranines are described as asymmetric diaminoazonium bases, and are prepared by the oxidation of a diamine and a monoamine. When paraphenylenediamine and aniline are thus treated, indamine results as an intermediate product, but upon further action with aniline hydrochloride and oxygen this yields phenosafranine, a compound containing three benzene rings. It dyes fabrics a beautiful pink color, and has recently been introduced into photography where it acts as a desensitizer for the photographic plate without destroying the latent image. A plate, once exposed, may thus be bathed in phenosafranine in darkness, then developed in subdued yellow light without suffering ill effects, or "fogging," a procedure which allows of a much closer control on the time of developing.

SAGE, MARGARET OLIVIA SLOCUM (1828-1918), American philanthropist, was born at Syracuse, N.Y., Sept. 8, 1828. She was educated at the Troy Female Seminary (later the Emma Willard School). She married RUSSELL SAGE in 1869, and after his death, 1906, devoted to philanthropy a large part of the fortune of between 60 and 65 million dollars which he had left to her unrestrictedly. In 1907, she established the Russell Sage Foundation for the betterment of social conditions, with gifts amounting to \$10,000,000. In 1910, she donated \$2,750,000 to be used in developing the Russell Sage Foundation Homes at Forest Hills, N.Y. Two years later, she purchased Marsh Island, in the Gulf of Mexico, to be maintained as a bird refuge. Her benefactions

during her lifetime were estimated at \$40,000,000, and her will bequeathed \$36,000,000 in institutional gifts. She died in New York City, Nov. 4, 1918.

SAGE, RUSSELL (1816-1906), American capitalist, born at Shenandoah, N.Y., Aug. 4, 1816. He was educated in the public schools and began work as an errand boy. He entered upon his business career with part ownership of a retail grocery store at Troy, N.Y., and during 1839-57 he was in a wholesale grocery firm there. In 1841, he was selected alderman in Troy; during 1845-49, he was treasurer of Rensselaer Co.; and he sat in Congress in 1853-57. He moved to New York city in 1865, associated himself with JAY GOULD in the latter's railroad operations, bought a seat on the stock exchange in 1874 and acquired a fortune estimated at between 60 and 65 million dollars. He left his wealth, wholly and unconditionally, to his wife, MARGARET OLIVIA SLOCUM SAGE. He died in New York City, July 22, 1906.

SAGE, RUSSELL, FOUNDATION. See RUSSELL SAGE FOUNDATION.

SAGE (*Salvia officinalis*), a bitterish aromatic perennial herb of the mint family used in flavoring dressings and sauces, especially for meats. It is a native of the Mediterranean region long cultivated as a culinary and medicinal plant and also in many foliage varieties as an ornamental. The slightly woody white-woolly stems, about a foot high, bear oblong wrinkled



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

CRIMSON SAGE

(*Salvia spathacea*). Stamen, flowering branchlet, leaf and flower

leaves and numerous purple, blue or white flowers in whorls. In California there are several native sages, some of which are valuable honey plants, as the black sage (*S. mellifera*) and the white sage (*S. apiana*). Various plants with ashy gray foliage, found from the Great Plains westward, are sometimes called sage as the sweet sage (*Eurotia lanata*), the red sage (*Kochia americana*) and the hop sage (*Grayia spinosa*). See SALVIA.

SAGEBRUSH, the name applied to several shrubby species of *Artemisia* of the composite family, found in high plateau regions from the Rocky Mountains to the Pacific coast. They are somewhat woody plants with hoary bitter foliage and a sagelike

odor. Of these the best known is the common sagebrush (*A. tridentata*), exceedingly abundant on high arid plains, notably in Nevada, which is known as the sagebrush state. The erect much branched shrub, usually 3 to 6 ft. high, with a distinct trunk and shreddy bark, bears narrow silvery, wedge-shaped leaves, mostly three-toothed at the apex, and small heads of yellowish flowers in diffuse clusters. Sagebrush usually grows on highly fertile soils which, when irrigated, will produce abundant crops. The shrub is utilized in some localities for winter forage and to a limited extent for fuel.



FROM JEPSON, MAN. FL.
PLANTS CALIF., COPYR.
SAGEBRUSH

SAG HARBOR, a village of Suffolk Co., Long Island, New York, situated on Shelter Island Sound, an arm of Gardiner's Bay, about 100 mi. east of New York City. The Long Island Railroad, buses and ferries to New London, Conn., and Shelter Island provide transportation. Suspension bridges, under construction in 1931, will connect it with Shelter Island and Greenport. Sag Harbor is a popular summer resort. It has several small industries. Potatoes and garden truck are grown in the vicinity. Pop. 1920, 2,993; 1930, 2,773.

SAGINAW, a city of eastern Michigan, the county seat of Saginaw Co., is located on the Saginaw River, about 85 mi. northwest of Detroit. The transportation facilities include the Père Marquette, the Michigan Central and the Grand Trunk Western railroads, truck and bus lines, lake boats and a municipal airport. Among the manufactures are foundry products, graphite products, auto parts, baking machinery, furniture, wood-working and wood-crushing machinery. In 1929 the industrial output reached approximately \$68,000,000; the retail trade amounted to \$47,321,600. The surrounding country produces grain, fruit and vegetables, especially sugar-beets. Nearby are oil, coal, bromine and chlorine beds.

The present city was founded in 1890 by the consolidation of Saginaw City, founded in 1822, and East Saginaw on the opposite side of the Saginaw River, founded in 1849. Pop. 1920, 61,903; 1930, 80,715.

SAGINAW BAY, a bay in Lake Huron, extending southwestward into the state of Michigan. It is situated in the eastern part of the state, at the mouth of the Saginaw River. It is about 60 mi. long and 35 mi. wide. It has an excellent harbor, accommodating the largest Great Lakes steamers.

SAGITTA (gen. *Sagittae*), the arrow, a small constellation consisting chiefly of four stars of the fourth

and fifth magnitude just north of Altair. See **STAR: map**.

SAGITTARIUS (gen. *Sagittarii*), the archer, the ninth constellation of the Zodiac, may be seen during summer evenings low down in the south. Though containing only two stars of the second magnitude and none of the first, Sagittarius possesses a wealth of faint stars as well as the brightest portion of the Milky Way, including many brilliant star-clouds. It forms a magnificent spectacle, especially in lower latitudes where it may rise high in the sky.

The constellation includes a number of bright double stars of the fourth and fifth magnitude which may be separated with a field glass or even with the naked eye. The Milky Way clouds in Sagittarius form an almost inexhaustible mine of **VARIABLE STARS**, several hundred being already known, while new ones are being discovered all the time. New stars also seem to appear with greater frequency here than in all the rest of the sky put together. In addition a large number of **STAR CLUSTERS** may be found here. From the great concentration of this variety of celestial objects in this region, as well as from consideration of the motion of the stars, it is believed that the center of the Milky Way system, the center of our universe, lies in this section, at a distance from us of some 50,000 light years. See **STAR: map**.

SAGO, an edible starch obtained from the inner part of the trunk of several varieties of palm tree, chiefly the sago palm, a native of the East Indies. The trees are cut down just before the fruit develops. The starchy pith is extracted from the trunk and grated to a powder. This is kneaded with water and the starch is strained off from the coarse woody fiber and washed, made into a paste with water and rubbed through sieves of varying degrees of fineness to produce grains of sago of different sizes. The finished product is marketed in the form of translucent granular globules. Sago, which is an important article of food in the East Indies and exported in large quantities to Europe and America, is used chiefly for thickening soups and puddings. It is also utilized as a stiffening agent in finishing various textiles.

SAGO PALM, the name given to the East Indian palms (*Metroxylon laeve* and *M. Rumphii*), extensively cultivated in Malaya, from which the sago of commerce is largely obtained. They are small trees the stems of which die after flowering. When the flower-buds appear the trees are cut down and the sago is prepared from the pith by crushing and washing. Sago is obtained also from several other palms and from various cycads, one of which (*Cycas circinalis*) is sometimes called sago palm.

SAGUARO (*Carnegiea gigantea* or *Cereus giganteus*), a remarkable leafless tree of the **CACTUS** family, known also as giant cactus and monument cactus. It is native to rocky hills and mesas in southern Arizona, southeastern California and adjacent Mexico, where it constitutes a striking feature of the desert vegetation. The trees grow 50 to 60 ft. high with a green fluted columnar trunk sometimes 2 ft.

in diameter, rising unbranched for its entire length or often with two or three very stout, nearly erect branches fluted like the stem. More rarely the trunk divides near the base into a group of crowded vertical branches resembling a cluster of organ pipes. The handsome creamy-white flowers, 4 in. long and $2\frac{1}{2}$ in. broad, open from May to July in great numbers near the top of the stem. These are followed by the red, fleshy, edible fruit, a huge berry $2\frac{1}{2}$ in. long, which ripens in August. The Indians utilize the light strong wood for various purposes and consume the juicy fruit for food. In the Papago Saguaro National Monument, near Phoenix, Arizona, there are many fine specimens of this superb cactus. The saguaro is the floral emblem of Arizona. *See also* CEREUS.

SAGUENAY RIVER, a stream of Quebec, Canada, remarkable for its depth and volume. It issues from Lake St. John over twin rapids and runs a swift course southeastward through a wilderness of pine- and spruce-covered hills to Chicoutimi. This upper stretch is about $\frac{1}{2}$ mi. wide and abounds in waterfalls. Below Chicoutimi the river has a width of from $\frac{3}{4}$ to 2 mi. and flows between stark, overhanging cliffs more than 1,000 ft. high, whose black shadows give it the aspect of a gloomy mountain loch. It enters the estuary of the St. Lawrence about 120 mi. northeast of Quebec. The river's length is 100 mi. Its lower reaches are very deep, attaining over 3,000 ft. at the mouth. The Saguenay is navigable for ocean-going ships for 57 mi. upstream to Ha Ha Bay.

SAGUNTUM, SIEGE OF. The first siege of Saguntum (now Sagunto), a Spanish town near Valencia, occurred in 219 B.C. Nine years before, the Romans, wishing to diminish the rising Carthaginian power in Spain, ruled that the Carthaginian general, HANSDRUBAL, should not pass beyond the Ebro River and formed an alliance with Saguntum to insure their own power. HANNIBAL determined to defy the Romans by attacking Saguntum. The city was able to withstand his army for eight months, but was finally sacked. The Carthaginian Council refused to surrender or punish Hannibal for his action. The incident was one cause for the Second PUNIC WAR.

Again in 1811, during the Peninsular War, the Spanish garrison at Sagunto was besieged by the French and was forced to surrender to them.

SAHAGUN, BERNARDO DE (?-1590), a Spanish Franciscan monk and historian, born in Leon early in the 16th century. He was sent to Mexico in 1529, where he dedicated himself to teaching and to the study of Mexican languages and history. His method consisted in gathering about him Indian scholars who wrote their accounts in their native languages. From these accounts his *Historia de las cosas de Nueva Espana* was compiled. Though not published until 1829, this work is probably the best account of the manners, customs and history of Mexico prior to the Spanish Conquest. Sahagun died in 1590.

SAHARA, a desert plateau of north Africa, the largest arid region in the world, with an estimated

area of 3,500,000 sq. mi. Its greatest length is 3,200 mi. and its breadth, north to south, varies from 850 to 1,400 mi. The Sahara stretches from the coasts of the Atlantic to the shores of the Red Sea, though the whole is not entirely a desert region but contains many districts where there are numerous fertile oases and some vegetation. The desert, which forms a barrier between North and Central Africa, has its historic links with the Mediterranean Sea and, since the present political control operates mainly southward from French Northwest Africa and Italian Libya, it may be conveniently included with the lands to the north. The Sahara is bounded on the south by the French and Anglo-Egyptian Sudan. On the east the region continues into the Nile lands and includes the Libyan and Nubian deserts. In the west, Spain holds a coastal strip, and Italy possesses a part, but the greater part of the arid region is under French control.

Surface Features. The Sahara is far from uniform in character. In the center there are well-defined mountainous regions presenting, like the sand, very formidable barriers. The entire area is crossed by dried-up river valleys known as *wadis* whether they occasionally contain water or not. The desert, moreover, is not uniformly sandy, for on the summits of the plateaus the ground is generally rocky and covered with large stones. These regions are known as *Hamadas* or *Gautras*, and when crossed by ravines, they are called *Chebkas*. In the sandy areas large dunes, or *Ergs*, are formed by the action of strong winds. The region known as *Tanezruft*, an absolutely sterile section without water or inhabitants, lies between the Ahraggar massif and the elevated country of Adrar. Wherever no vegetation occurs in these parts, the rocks forming the surface of the desert weather much more quickly than where they are protected by plants. Through alternate heating in the daytime and cooling at night, small fragments are splintered off which gradually become fine sand. The sand is shaped into huge dunes by the wind, so that in a journey over these areas it is impossible to see for any great distance.

The greater part of the Saharan region lies below 1,500 ft. in altitude, although the central belt exceeds this elevation. The line of depressions separating the Atlas region from the main Saharan plateau includes the Adrar area in Mauritania (El Juf), the Tuat depression, and the region marked by the Shott el Jerid and the Shott Melghir, the latter being about 100 ft. below sea level. The Bodele depression occupies a large area in the Military Territories northeast of Lake Chad. In the central Sahara the Ahaggar massif is connected with the massif of Air on the south, and flanked on the northeast by the Tasili plateau. From here an elevated belt runs southeastward through the Marra Mountains and the Tibesti highlands to Dar Fur in the Sudan. This high heart of the Sahara exceeds 6,000 ft. in only a few places. It broadly represents the crystalline foundation of Africa, a relic of the ancient plateau of a higher level. Primary rocks flank the higher parts, and there is a great deal

of intrusive granite as well as volcanic rocks, particularly well represented in the Air massif.

Inhabitants. There is a considerable diversity and mixture of peoples in the Sahara. Broadly speaking 17° N. lat. separates Arab and Berber from Negro types. Thus in Mauritania Arabs and Berbers are found in the north and blacks in the south. Ahaggar and Air are inhabited by the Tuareg, "the people of the veil," an interesting Berber type. The men go veiled, scorn manual work despite their strength, and constitute a tribe of camelmen who long dominated the chief Saharan caravan routes and who have only recently been subdued by the French. They are not numerous, and it seems probable that they will die out. The only activity that appeals to them is marauding, and they are mixing more and more with Negro types that the slave trade brought to the oases. To the east, in the Bodele and Tibesti regions, the inhabitants are chiefly Tibbu types, Hamitic Negroes, the only Negro people to maintain themselves in the Sahara, and a sprinkling of Arabs. In the north and west chiefly Arabs of two kinds are found: settled Arabs, living in flat-roofed mud houses at the oases; and nomadic tribes, living in tents and wandering in the semi-desert from well to well. The need for pasture and water has largely contributed to the unruliness of the Saharan peoples, and their resistance to European penetration has been frequently increased by a fanatical Mohammedanism. The last stronghold of the slave trade was the Wadai region, lying east of Lake Chad.

Oases. The principal oases of the northern Sahara are Wargla, Biskra and Tuggurt, in southern Algeria, irrigated from deep wells; Tuat, Guara and Tidikelt, areas containing numerous watering places, lying to the southwest of Algeria; Tafilet, a large oasis in the south of Morocco, containing many villages; Adrar, an elevated district with several fertile spots, to the east of Rio de Oro; and Ghadames, Ghat and Murzuk in Libya. In the Libyan Desert the chief oases are Siwa, Jarabub and Kufrah, the two last being cities of the Senussi, a fanatical Mohammedan sect whose headquarters are at Kufrah in the center of the desert. Large quantities of dates are grown at the oases; the Degla variety is specially cultivated for export. Various other fruits, barley and millet are grown.

Rivers and Drainage. The Sahara has only a "fossil" river system, a series of *wadis*, with the principal focus in the Ahaggar-Tasili highlands. These represent the immature river system developed during the glacial epoch in Europe. In the Atlas region are short rivers, with a considerable winter flow which provides the only drainage to the sea in this large division. The Ahaggar massif may be regarded as an important water parting in that it marks the divide of considerable drainage systems that were being developed during the glacial epoch. Wadis now occupy deep valleys, the erosion of which was arrested by desiccation. It is believed that the Wadi Igharghar, formerly drained to the low shotts of southern Algeria, and that the Wadi Tafassaset, which drained

the eastern part of the Ahaggar massif to the Niger, received the river of Agades from Air. It seems probable that the elephants used by the Carthaginians, which were obtained from the lowland shotts region, crossed the Sahara by the Ahaggar massif. In the northern valleys of the Ahaggar degenerate crocodiles have been found. There is evidence that desiccation has continued to the present time.

Another important drainage feature is found in the numerous wadis that drain southward from the Atlas Mountains, and which come down in flood during the winter. At Beni Abbes the Wadi Saura floods several times a year. Occasionally the wadis themselves provide water for the oases; but very important also is the vast quantity of water that lies underground in this part of the Northern Sahara. Wadis from the Tibesti highlands drain to the Bodele depression, which appears to have been formerly filled with water from Lake Chad.

Flora and Fauna. Innumerable date palms are found at the oases. Acacia trees are plentiful on the Hamadas. The desert plant-life is confined principally to acacias, tamarisks and coarse grasses.

The jackal, fox, antelope, gazelle, badger and hare are found in the desert. The lion is now almost extinct. Reptiles include horned vipers, lizards, scorpions and a few crocodiles.

Climate. There is a great range of temperature throughout the day. In northern areas during the winter the thermometer frequently sinks below freezing point at night and rises in the daytime to over 100° F. On the high plateaus of the central Sahara the almost complete absence of all flora and fauna is largely due to the great differences in heat and cold and to the incessant winds. In the Ahaggar highlands the variation of temperature is excessive. Generally the climate of the Sahara, unfriendly to flora and fauna, is healthful for man. Intense heat gives rise to the wind storms known as *simoons*, which fill the air with sand and drive fine particles into the pores of the skin.

During the late summer some rain falls on the southern margin of the desert as a result of a brief monsoonal incursion of southwesterly winds which blow from the Gulf of Guinea. These winds penetrate underneath the prevailing easterly or northeasterly winds, probably to a height of about a quarter of a mile, and the rainfall appears to be generally of a vigorous convectional type. The convection apparently mixes the opposing currents and often leaves the easterly wind in temporary occupation of even the lowest layers. Occasionally this process gives rise to tornadoes of the African type, which are of the nature of line squalls and are not destructive vortices like the tornadoes of the United States.

The rainy season is complicated and interrupted by various breaks. As in many other parts of Africa, the more mountainous districts are likely to get abundant rain, while the relatively low-lying plains not only have a very small annual fall, less than five inches, but also one that is capricious; in large areas a scanty

desert vegetation is maintained only precariously. Snow rests temporarily in winter on the highest parts of the Ahaggar, where there is a modification of temperature probably amounting to 12° F. in comparison with the surrounding Sahara. Good pasture land for goats, sheep, donkeys, and camels is found in these highlands.

Caravan Routes. Desert transport depends on the camel, the only animal that can cross the waterless wastes. There are two varieties: the *jemal*, or slow beast of burden, and the *mehari*, or riding camel, tall and swift. The position of oases decides the course of caravan routes. In a region without obvious landmarks the sun and the stars are guides, and the desert training of the caravan leader is of supreme importance. But caravan trade has shrunk to relatively small dimensions; slave trading has been all but abolished, railroads to the Mediterranean tap the northern Sahara, and the Sudanese zone has had its traffic diverted westward and southward. The purchasing power and the products of the dwellers in oases and highlands cannot justify extensive railroad or motor transport. Routes have been investigated by the French for the construction of a trans-Saharan railroad.

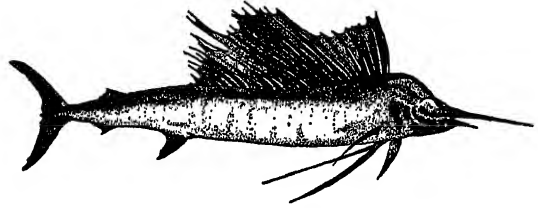
Development. As a whole the Sahara has now no great possibilities for important economic development. The French, however, are energetically pursuing the search for underground water, and may to some extent increase the habitability of the region. Another limiting factor is the dependence upon camel transport. The growing importance of north Africa as a tourist region is reflected in the development of motor roads, which of course have economic value as commercial automobile transport increases. It is possible now for the tourist to cross the desert from Algiers to Timbuktu in special automobiles, but this is not to suggest that the problem of desert transport is solved. A feature of the control of north Africa by the French is the success with which they have on the whole gained the confidence of the native population by carefully respecting their traditions and customs (the slave trade, however, being abolished). This result naturally came after prolonged military campaigns, for Arab and Berber alike resent European intrusion. The population, estimated at 800,000, is mainly concentrated at the oases, and tends to be nomadic on the desert margins and in the interior highlands. *See also* AFRICA, HISTORY AND EXPLORATIONS.

SAIGA, a rare antelope (*Saiga tatarica*) of the arid plains of Turkestan. It is remarkable for its strangely inflated nose and sheeplike fleece. The lyrate, amber-colored horns of the male have great market value as material for making Chinese medicines. Hence this antelope is now protected by Russian law.

SAIGON, the capital and chief commercial center of Cochinchina situated on the eastern fringe of the Mekong delta, 34 mi. from the China Sea. The city is served regularly by the liners of French and other steamship companies. The chief exports are rice,

fish, pepper, cotton, copra, rubber and spices. Apart from its populace, Saïgon is a French provincial town. Est. pop. 1930, 143,306.

SAILFISH, the general name for a small family (*Istiophoridae*) of mackerel-like fishes allied to the **SWORDFISH**, found widely in warm seas. They are of large size and brilliant metallic coloration, and armed with a formidable sword-like snout formed by the prolongation of the bones of the upper jaw. Sail-



fishes are in some localities highly esteemed for food, their delicately flavored flesh resembling that of the swordfish, and, because of their strength, agility and gaminess, are of great interest as a sport fish. The Atlantic sailfish (*Istiophorus americanus*), found on the coast of Florida and southward, bluish-black above and whitish below, attains a length of about 6 ft. and sometimes weighs upwards of 90 lbs. It is strikingly characterized by its very conspicuous, sail-like back fin, which is blue in color marked with black spots.

SAILFISH FISHING. *See* ANGLING.

SAILORS' SNUG HARBOR, a home for seamen, established through the bequest of Captain Robert Richard Randall, for the purpose of maintaining and supporting "aged, decrepit, and worn-out sailors." A 130-acre site on Staten Island, N.Y., was selected and the institution was formally opened on Aug. 1, 1833. More than 800 men are now cared for annually. The home is administered by a board of trustees, including the Mayor of New York City, the President of the Marine Society of New York, and the senior members of the Episcopal and Presbyterian churches in New York, and a Governor, appointed by the trustees.

SAINFOIN (*Onobrychis viciifolia*), a perennial herb of the pea family called also holy clover and esparcet. It is a native of Europe and temperate Asia, extensively cultivated in Europe as a hay and pasture plant and sparingly grown in the southern United States. The stems, about a foot high, bear pinnate leaves of numerous oblong leaflets and pink, pealike flowers in axillary spikes. In North America alfalfa (*Medicago sativa*) and the Canadian or showy tick-trefoil (*Desmodium canadense*) are sometimes called sainfoin.

SAINT, a term applied in the Catholic Church at first to certain specified Christian martyrs. In later centuries the meaning was broadened to include certain bishops and later still, ascetics leading a pure and Christian life. St. Paul called all the faithful

saints. In medieval as well as in modern times the working of miracles has invariably been associated with the saints. These miracles have generally taken the form of divine intervention at the intercession of the saint in the relief or alleviation of physical suffering, or of divine deliverance from physical evil. The saints have their feast days on which they are celebrated, and a list of such anniversaries forms the *Martyrology*. The cult of martyrs began as early as the 3rd century, but it was not until the 6th century that the cult of saints was put on a firm basis by the Church. See CANONIZATION.

ST. ALBANS, a city and municipal borough of Hertfordshire, England, situated on a hill above the small River Ver, 20 mi. northwest of London. The place name derives from the first Christian martyr in England, a Roman soldier who in 303 was beheaded at the then *Verulamium*. In 793 a monastery in his memory was founded and became subsequently the most powerful in England. The abbey church, which since 1877 has been a cathedral, was not built until after the Conquest, and, like the earlier monastery, was largely quarried from the remains of Verulamium. Though much restored and rebuilt, the cathedral retains much of its original proportions, the Roman tiles lending a particularly severe aspect to the Norman architecture. Its nave is one of the longest Gothic naves in the world. Among other local churches, St. Michael's, originally 10th century, contains the tomb of Sir Francis Bacon. Cowper, the poet, and Dickens are associated with the ancient, picturesque houses of Saint Albans, and the first English translation of the Bible was printed at its abbey. Printing still remains important, together with the manufactures of silks and brushes. There are also breweries and foundries. Pop. 1921, 25,593; 1931, 28,625.

ST. ALBANS, city and port, county seat of Franklin Co., Vt., 28 mi. north of Burlington. It is served by the Central Vermont Railroad and lake steamers. St. Albans Bay, Lake Champlain, is a popular tourist fishing ground. Here, because of proximity to Canada, are numerous Federal bureaus and services. From the port are shipped maple sugar, dairy and other products, and exports and imports average about \$50,000,000 annually. The main offices and shops of the Central Vermont Railroad are located here. St. Albans was settled in 1774, the town organized 1788, incorporated 1859 and the city chartered in 1897. A commission management now governs. The town witnessed Civil War and Reconstruction period raids. Pop. 1920, 7,588; 1930, 8,020; 85% native white.

ST. AMANDO, HUCBALD DE. See HUCBALD DE ST. AMANDO.

ST. ANDREWS, UNIVERSITY OF, at St. Andrews, Fifeshire, Scotland, a coeducational institution, is the oldest university in Scotland. It originated in a society formed by Bishop Lawrence of Lindores in 1410, chartered by Bishop Henry Wardlaw in 1411, and constituted by Pope Benedict XIII in 1413. St. Andrews had three colleges: the Pedagogium, founded

by Bishop Wardlaw; St. Salvator's, founded by Bishop James Kennedy; and St. Leonard's. The Pedagogium, reestablished in 1537 as the College of St. Mary, became the theological school, a stronghold of Protestantism during the Reformation. In 1747 St. Leonard's and St. Salvator's were incorporated as United College. The number of students enrolled annually is about 600. In 1930 the faculty of 30 was headed by the Rt. Hon. STANLEY BALDWIN, Chancellor.

ST. AUGUSTINE, a port city on the northeastern coast of Florida, the county seat of St. Johns Co., situated on the Matanzas River, 40 mi. south of Jacksonville. The city is served by the Florida East Coast Railroad, by steamships and by bus and truck lines. The retail trade in 1929 reached a total of \$6,150,572. St. Augustine is the oldest permanent settlement in the United States. On his search for the fabled Fountain of Youth Ponce de Leon is said to have landed in 1513 at the site of St. Augustine. Pedro Menéndez de Avilés sailed into the harbor in 1565, established a settlement and built fortifications. Sir Francis Drake burned the town and seized the fortress in 1586, and the English buccaneer, Capt. John Davis, attacked the city in 1665. St. Augustine was under British rule from 1763 to 1783. The Spanish held control again, until 1821, when Florida came under the government of the United States. St. Augustine still keeps the character of a quaint Spanish town, with San Marco, now Ft. Marion, recalling the days when it was built by the Indians under the lash of the Spaniards. The gates of the ancient walled town still stand. Many streets are flanked with beautiful old houses with projecting balconies, and some of the newer buildings have preserved the Spanish style of architecture. The city is a fascinating resort for tourists, with its beach, handsome trees, shrubbery and flowers. The chief industries are cigar manufacture and food canning. Farm products, especially potatoes, are grown in the vicinity. The present incorporation of the city dates from 1925. Pop. 1920, 6,192; 1930, 12,111.

ST. AUGUSTINE GRASS (*Stenotaphrum secundatum*), a small creeping perennial, called also shore grass, extensively planted in the far South for lawns. It grows wild near the coast from North Carolina to Texas and tropical America. The stems, 3 to 12 in. high, bear widely spreading leaves and narrow flat flowering spikes.

ST. BARTHELEMY, or **ST. BARTHOLOMEW**, an island of the West Indies, one of the dependencies of the French Guadeloupe colony. It is situated about 130 mi. northwest of Guadeloupe and is very irregular in shape. The area is but eight sq. mi. The island rises gradually from the water edge to a single limestone hill about 1,000 ft. above the sea. Partly of volcanic origin, St. Barthelemy is practically destitute of fresh water. Nevertheless its soil is very fertile, producing tobacco, cotton, sugar, cacao and mandioca. The only towns are Gustavia, which has a small but safe harbor, and Lorient. The island

was first colonized by the French in 1648. In 1784 it was taken by Sweden, from which country France bought it in 1877. The inhabitants number fewer than 3,000 and are of Negro and French descent, but use the English language.

ST. BARTHOLOMEW, MASSACRE OF. See BARTHOLOMEW, ST., MASSACRE OF.

ST. BASIL'S CATHEDRAL, a famous Russian church, standing at the southern end of the Red Square in Moscow. Built during the reign of Ivan the Terrible (1554-60) to commemorate the conquest of Kazan, it is an example of the magnificent decorative and ornate style of the old-Russian architecture. Paintings of a later period adorn the interior, which has eight smaller altars arranged around a central altar. In 1921-24 the church was restored and has become a museum of the Soviet Government. Since the Revolution a collection of plans, drawings and manuscripts about the Cathedral are exhibited in the bell tower.

ST. BERNARD, a city in southwestern Ohio, a residential suburb of Cincinnati having passenger service on two railroads and freight connections with several others. The city has various industries. Pop. 1920, 6,312; 1930, 7,487.

ST. BONAVENTURE'S COLLEGE AND SEMINARY, a Catholic institution for men founded by the Franciscan Fathers in 1859 at Allegany, N.Y. It comprises colleges of Arts and Sciences, and Education, and has Preparatory, Graduate, Extension and Summer schools. The buildings and grounds were valued in 1931 at \$1,198,000. The library contained 26,000 volumes. In 1930 the student enrollment was 654, and the faculty of 48 was headed by Pres. THOMAS PLASSMANN.

ST. BONIFACE, a city of Manitoba, Canada, situated at the junction of the Red and Assiniboine rivers, directly across from Winnipeg. Industry, agriculture, and inexpensive hydroelectricity have contributed to the city's growth. There are linseed oil refineries, paint and varnish distilleries, flour mills, steel works, paper manufacturing plants and stock yards. A colorful city, St. Boniface is the center of French and Catholic western Canada. It contains a fine cathedral, 1908, which replaces an earlier edifice burned in 1860. Settled by the French in 1775, it was formally founded in 1817 by the Des Meurons regiment which escorted Lord Selkirk and his colonizers to the site. St. Boniface was incorporated as a town in 1883 and as a city in 1908. Pop. 1921, 12,821; 1931, 16,305.

ST. CATHARINES, a city and the capital of Lincoln Co., Ontario, Canada, well-situated on the New Welland Canal, 35 mi. from the city of Buffalo, N.Y., on Lake Ontario. Power derived from the Niagara hydroelectric development 10 mi. southeast supplies local flour, textile, paper and rubber mills, machine shops and metal products factories, as well as other industries. Fruit growing is important in the environs, and there are curative saline springs nearby which attract visitors and make of the city a summer resort. Among educational foundations are Bishop

Ridley's College. St. Catharines has parks, adequate public works and an airport. The city was incorporated in 1875. Pop. 1921, 19,881; 1931, 24,753.

ST. CHARLES, a city in northeastern Illinois, in Kane Co., situated 39 mi. west of Chicago, on the Fox River. Bus lines and several railroads serve the city. There is a private airport nearby. St. Charles is a shipping market for dairy products and an industrial center, manufacturing pianos, radio accessories, malleable iron products, musical instruments, and various other commodities. Evans game farm is located here. St. Charles was founded about 1833 and incorporated in 1874. Pop. 1920, 4,099; 1930, 5,377.

ST. CHARLES, a city in eastern Missouri, the county seat of St. Charles Co., situated on the Missouri River, 22 mi. northwest of St. Louis. Two railroads serve the city, which has various local manufactures. The retail trade amounted to \$5,322,579. Lindenwood College and Emmaus Asylum for Epileptics are located here. The city was founded by the French in 1769; the Spanish came soon afterwards. St. Charles was the capital of the Northwest Territory, and the state capital from 1820 to 1826. Pop. 1920, 8,503; 1930, 10,491.

ST. CHRISTOPHER or **ST. KITTS**, a small island in the Lesser Antilles, British West Indies, in 17° 18' N. lat., 62° 43' W. long., belonging to the colony of the LEeward ISLANDS. The island, of which Basseterre is the capital, is cut in mid-section by a chain of mountains, rising to a maximum of 3,700 ft. The island area is 63 sq. mi., and its length 22½ mi. Cotton, tobacco and coffee are cultivated on the fertile slopes of the mountains, and other products include sugar, salt and molasses. Horses and cattle are raised. The island was discovered in 1493 by Columbus and was occupied by the British in 1623. In 1628 the British shared Saint Christopher with the French. Until 1713, when the British came into full possession of the island, Saint Christopher was the scene of bitter struggles between French and English. Est. pop., with Nevis, 1930, 30,933.

ST. CLAIR, a borough in Schuylkill Co., eastern Pennsylvania, situated on Mill Creek, 3 mi. north of Pottsville. It is served by two railroads. Anthracite coal-mining and coal classification are the principal industries. St. Clair was founded in 1825; incorporated in 1850. Pop. 1920, 6,495; 1930, 7,296.

ST. CLAIR, LAKE, a body of water situated on the boundary between Michigan and the province of Ontario. Lake Huron drains into it from the north through the St. Clair River; and the lake in turn empties into Lake Erie through the Detroit River. St. Clair Lake and the two rivers form a channel 100 mi. long which is an important commercial waterway for lake traffic. The lake has a surface area of about 400 sq. mi. and is shallow throughout, its maximum depth being about 23 ft. Its elevation is about 575 ft. above sea level. The shoals and bars originally at the mouth of St. Clair River and at the entrance to Detroit River have been removed to provide an ade-

quate ship channel since all the commerce passing between the upper and lower lakes goes through Lake St. Clair. In 1929 this traffic amounted to 110,719,845 tons. The city of Detroit is situated on the Detroit River just below the lake.

ST. CLOUD, a city in central Minnesota, the county seat of Stearns Co., situated also partially in Benton and Sherburne counties, on the Mississippi River, 75 mi. northwest of St. Paul. Bus lines, airplanes and two railroads afford transportation. The principal crops of this region are grain and tobacco. The city is a very large granite producing center. Stock-raising and dairying are extensively engaged in. The principal industries are flour milling and the manufacture of paper, sashes, doors, freight cars and motor parts. St. Cloud is the seat of a State Teacher's College, the State Reformatory and a United States Veterans' Hospital. The city was founded in 1854 and incorporated in 1856. Pop. 1920, 15,873; 1930, 21,000.

ST. CROIX RIVER, a river of Wisconsin, formed by branches rising in Douglas and Bayfield counties in the northwest corner of the state. It flows southward to the western border of the state where, by turning south it forms the boundary line between Minnesota and Wisconsin. After a course of 200 mi. it joins the Mississippi at Hastings, Minn. The St. Croix flows through a hilly, wooded country noted for its scenic beauty. At Stillwater, the largest city on its course, the river widens to the expanse of a lake and was the location of a log boom when the lumber industry was at its height in that section. Midway in its course are several rapids, principally at St. Croix Falls.

SAINT-CYRAN, a French Benedictine abbey in Berry, Loiret. One of the most famous names connected with this abbey is Vergier, a celebrated Jansenist who was layman and abbot in *commendam* during the period 1620-43, and who is often known as the Abbé de Saint-Cyran.

ST. CYR MILITARY SCHOOL. The École Spéciale Militaire at Saint Cyr, France, trains civilians to become army officers. Upon graduation they are commissioned in the infantry, cavalry, tank corps and air corps. The age for entering is between 17 and 23. To be eligible for the course at Saint Cyr the candidate must be a French citizen, either native-born or naturalized. There are about 380 students at the school and they are admitted as a result of competitive examinations for the vacancies. The course comprises general military instructions, tactics, history, topography, applied sciences, engineering, legislation, administration and modern languages. In addition particular attention is paid to practical military training, such as fencing, riding and general physical training.

Students at Saint Cyr are required to pay for their expenses, which are approximately 1,400 francs a year for living expenses and 2,500 francs for the cost of uniforms and equipment. Upon entering this institution all students are required to agree to re-

main in the army six years after graduation. Upon graduation they are commissioned second lieutenants and choose their assignments to arms of the service in accordance with their class standing. Assignments, however, remain dependent upon the actual vacancies existing at the time of their being commissioned. They do not go immediately to duty with troops but are sent to the schools of application of their respective arms of service where they specialize for two years more. See also UNITED STATES MILITARY ACADEMY.

S. J.

ST. DAVID'S, a cathedral town of Pembrokeshire, Wales, situated near the Alun and the sea, southeast of St. David's Head, the most westerly promontory of South Wales, and about 219 mi. northwest of London. The town has grown up about a cathedral built upon the site of a monastery of which St. David was abbot. Two early cathedrals were destroyed by Danes, the present edifice being largely of the 12th century. In the Middle Ages pilgrims believed a visit to St. David's to be of particular spiritual importance. During the Reformation and the Civil Wars the town greatly suffered. The 14th century episcopal palace is now roofless, but remains imposing. Pop. 1921, 1,644.

ST. DENIS, a manufacturing suburb of Paris, celebrated for its abbey church, the burial place of the kings of France. The city has metallurgical works, and important manufactured products are pianos, nickel plate, glassware, chemicals, oils and potteries. The cathedral, mainly of the 12th century, built over an earlier crypt, marked a decisive step in the transition from Romanesque to Gothic architecture. The tombs were desecrated during the Revolution but the monuments were later restored. Pop. 1931, 82,412.

SAINTE-BEUVE, CHARLES AUGUSTIN (1804-69), French critic, was born at Boulogne-sur-Mer, Dec. 23, 1804. He decided to enter the medical profession and while training began to contribute articles on literature and history to the Paris press. He soon became recognized as a leading critic. His *Causeries du lundi* first began to appear in 1849 and by 1862 they formed 15 volumes. His *Nouveaux lundis*, when reprinted, formed 13 more. Sainte-Beuve was known as the "smiling critic," the ferocity and acrimonious spirit animating many French critics being entirely alien to his method. He died in Paris, Oct. 13, 1869.

SAINTE CHAPELLE DU PALAIS, a perfect example of developed Gothic architecture erected in Paris in 1242-47, during the reign of Louis IX. It was attached to the royal palace, now the Palais de Justice, and served as a royal chapel and as a repository for sacred treasures, including the Crown of Thorns and fragments of the true Cross. The structure attains height by having a lower or basement chapel beneath the main chapel, which is preceded by an open porch. It has no columns and terminates in a polygonal apse in which once stood the shrine of the relics. Of special interest are its stained glass windows and the carvings on the exterior.

ST. ELIAS, MOUNT, a volcanic mountain in the Coastal range of southern Alaska and northwest Canada. It is the corner post of the international boundary between Alaska and the Yukon country and its summit, rising to an altitude of 18,008 ft. may be claimed by both countries. Glaciers entirely cover its steep southern slope and extend to the seashore. The northern slope is also almost destitute of vegetation and practically snow-covered but is more accessible. This peak was first ascended in 1897 by Prince Luigi of Savoy. It was discovered by Vitus Bering in 1741 and up until 1890 was considered much higher than Mt. Logan 26 miles northeast of it. From a distance it appears higher, but measurements made in 1890 by a party of American surveyors revealed its elevation to be 1,842 ft. beneath Logan. The ice fields between these two peaks give origin to the great Seward glacier.

ST. ELMO'S FIRE, a phenomenon of atmospheric electricity, incident upon a thunderstorm or the presence of thunderclouds, when great differences of electrical potential exist between the earth and the atmosphere. It is observed at night as a brush discharge from all pointed objects projecting from the ground. When negative electricity is being discharged the objects appear bathed in a bluish light; when positive, reddish streamers up to several inches long protrude in all directions.

ST. ÉTIENNE, an industrial town in east central France and capital of the department of the Loire. Although well known for its national arms manufacture it is important chiefly for a coal basin, which is one of the largest and best in France. In addition to firearms St. Étienne has thriving manufactures of ribbons, hardware, automobiles and farm implements. Pop. 1931, 191,088.

ST. EUSTATIUS, or **ST. EUSTACHE**, an island of the Lesser Antilles, in the Dutch West Indies, situated about 12 mi. northwest of St. Christopher or St. Kitts. It is formed of a number of volcanic hills which are intercepted by deep valleys. The highest elevation, a symmetrical cone, rises to a height of about 2,000 ft. The climate is healthful, but the island is frequently subjected to earthquakes and is harassed by hurricanes. Tobacco and sugar cane are the chief products. The capital is Orangetown. St. Eustatius forms part of the Dutch colony of Curaçao (see CURAÇAO). Pop., 1929, 965.

SAINT-EVREMOND, CHARLES DE (1610-1703), French writer, was born at Saint-Denys-le-Guast, Apr. 1, 1610. He abandoned law for a military career, distinguishing himself at Arras (1640), and being wounded at Nordlingen (1645). His devotion to the king during the Fronde was rewarded by court appointments. His comedies, *Les Académistes*, 1642, and *Les Maximes*, 1647, brought him fame, but his denunciatory writings led to his condemnation to the Bastille. He escaped in time to London, where he died Sept. 29, 1703.

ST. FRANCIS RIVER, a river of Missouri, rising in St. François Co. in the southeastern part of the

state. It runs southward into Arkansas and continues in the same general direction until it empties into the Mississippi about 9 mi. above Helena. Of its length of 450 mi. about 150 mi. are navigable. The river follows an uneven winding course through low, swampy country interspersed with bayous and in its lower reaches expands into a lake about 5 mi. wide. This lake forms an important reservoir in flood times.

ST. GALL or **ST. GALEN**, a leading city of Switzerland, capital of the canton of the same name, ranking high among the important industrial and commercial cities of Switzerland and center of the St. Gall and Appenzell embroidery industry. The city grew up around the abbey founded by the Irish missionary St. Gall in the 7th century, which in the 8th to 10th centuries was one of the most famous schools in Europe and its abbot very powerful until the secularization in 1805. The present buildings were erected in the 18th century and include the baroque abbey church, now a cathedral, the library with records from 630, and the quadrangle, used to-day for governmental offices. Other churches, museums, quaint houses and parks are interesting features. Pop. 1930, 64,120.

SAINT-GAUDENS, AUGUSTUS (1848-1907), American sculptor, was born at Dublin, Ireland, Mar. 1st, 1848, of a French father and an Irish mother. He came to the United States as an infant with his parents, and grew up in New York. He first studied at Cooper Union and the National Academy of Design. In 1868 he went to Paris, where he was a pupil at the Ecole des Beaux Arts, under Jouffroy. Later he spent three years at Rome, and the commissions he received at this time started him on his career. On his return to New York in 1873, his work began to attract attention. It represented the French school of sculpture of the time and such distinction and taste had been unknown in American work. When in 1881 his statue of Admiral Farragut was unveiled in Madison Square, New York, Saint-Gaudens was acclaimed as a great artist. In his subsequent work he lifted American sculpture to a high plane, distinguished by superb modeling, graceful design and poetic conception. His small portraits, done in low-relief, have particular charm of characterization, and among these may be mentioned the portraits of Bastien-Lepage, Robert Louis Stevenson, and William M. Chase. A copy of *Amor Caritas* was purchased by the French Government, which had made Saint-Gaudens an officer of the Legion of Honor and a member of the Institute of France. Among other important works are the statue of Lincoln, at Lincoln Park, Chicago; the Adams memorial in Rock Creek Cemetery, Washington, D.C.; the equestrian statue of Gen. Sherman, in Central Park, N.Y.; the Phillips Brooks monument, in Boston, and Parnell in Dublin. Saint-Gaudens died at Cornish, N.H., Aug. 3, 1907.

ST. GEORGE'S CHANNEL, an arm of the Atlantic Ocean, connecting that body with the Irish Sea and separating the southeastern part of Ireland from England and Wales. It is about 100 mi. long, with a breadth varying from 50 to 95 mi. The narrowest

point is between Carnsore Point in the county of Wexford, Ireland, and St. David's Head in Wales. Through this channel the tide enters the Irish Sea.

ST. GERMAIN, TREATY OF, the second of the five peace treaties made by the Powers at the PARIS PEACE CONFERENCE. Although completed before the Germans signed the TREATY OF VERSAILLES, it was not submitted to the Austrians till June 2, 1919. They were told they might make written observations but that no amendments were permissible. To the protest of the Austrian delegation, that Austria was a new state just as was Czechoslovakia and Poland, the Allies replied that Austria was an old state merely deprived of the outlying territories. To bring the treaty into harmony with this idea, they dropped the reference to "the Republic of Austria" as a "new and independent State" and stated in the preamble that the former Austria-Hungarian Monarchy has now ceased to exist and is replaced by a Republican Government.

Austria was forbidden to join Germany and ordered to abstain from any act which might compromise her independence. She lost all contact with the sea, and all her earlier subject peoples as well as some Germans. She ceded Trentino and southern Tyrol, with 250,000 Germans, Trieste, Istria and small islands off the Dalmatian coast to Italy. Czechoslovakia obtained part of Lower Austria, Austrian Silesia, Moravia and Bohemia, including about 3,000,000 Germans. To Poland was ceded Galicia; Rumania was given the Bukovina, and Yugoslavia obtained Herzegovina and Bosnia along with certain ports and islands of the Dalmatian coast. From a population of 30,000,000, Austria was reduced to a small landlocked state of only 6,500,000. The army was reduced to 30,000, and the navy was surrendered to the victors. Right of transit was allowed to the troops of Czechoslovakia, and Austria agreed to pay reparations as decided upon by the Reparations Commission. The treaty was signed on Sept. 10, 1919.

ST. HELENA, a lonely island and British possession in the South Atlantic, 1,200 mi. from the west coast of Africa and 4,477 from Southampton, in latitude 16° S. Area 47 sq. mi., extreme length, 10¼ mi., extreme breadth 8¼ mi. Population (1925) 3,747, comprising British, Dutch and Portuguese. A detachment of the Royal Marine Artillery is stationed here.

St. Helena is a rugged island, volcanic in origin, and with precipitous cliffs rising to 2,700 ft. The fortune of St. Helena has varied with the changes in ocean transport. It was formerly an important victualing station for ships on the Cape of Good Hope route when ocean transport was by sailing ship and the Suez Canal was not available. The island was formerly covered with redwood and ebony forests, but goats which were introduced have ruined the vegetation, and rain has washed a large amount of soil from the slopes. Domestic animals and many trees and plants have been introduced, and not very successful attempts have recently been made to find a mar-

ket for early potatoes. The introduction of phormium, or New Zealand flax, has been more profitable. Fibre and tow to the value of about \$200,000 are exported in some seasons. Four mills are in operation, and a lace-making industry has been established.

The island was discovered by the Portuguese in 1502, when it was uninhabited. The British East India Company took possession in 1651, after Portuguese and Dutch occupation had come to an end. St. Helena was Napoleon Bonaparte's prison from 1815 to his death in 1821. Jamestown, the port and only settlement, is an important cable station. In 1922, Ascension Island was made a dependency of St. Helena.

ST. HELENA, a city in Napa Co., northwestern California, situated 64 mi. north of San Francisco and served by bus lines, electric railway and the Southern Pacific Railroad. The vicinity yields large crops of grapes and prunes. St. Helena Sanitarium and the Pacific Union College are nearby. The city is surrounded by health and pleasure resorts, splendid scenery, mineral springs and geysers. Robert Louis Stevenson wrote *The Silverado Squatters* on the slopes of Mt. St. Helena, which stands at the head of the Napa Valley. The city was founded in 1853 and incorporated in 1876. Pop. 1920, 1,346; 1930, 1,582.

ST. HELENS, a town of Lancashire, England, 12 mi. northwest of Liverpool. An important coal mining center, St. Helens has grown from a small village to a large manufacturing center for glass, and has extensive alkali, copper smelting and iron works. There are good transportation facilities including a canal connecting the town with the Mersey River. Nearby are the ruins of Windleshaw Abbey and St. Thomas's Well. Pop. (of county borough) 1921, 102,640; 1931, 106,793.

ST. HYACINTHE, a city and the capital of St. Hyacinthe Co., a port of entry in Quebec, Canada, situated about 36 mi. northeast of Montreal, on the Yamaska River. Served by several railroads, it is an important distributing point for the vicinity, and manufactures leather goods, woollens, and agricultural implements. The city also has a celebrated organ factory. A pleasant French-Canadian city, it was swept by fire in 1903, and has since been rebuilt. Pop. 1921, 10,859; 1931, 13,448.

ST.-IGNATIUS'S-BEAN, the seeds of a small tree (*Strychnos Ignatii*) of the logania family allied to *nux vomica*. The tree is a native of southeastern Asia and the Philippine Islands. It bears a large pear-shaped fruit containing numerous brownish seeds, about the size of an olive, which, like *nux vomica*, have been used as a source of strychnine.

ST. ISAAC'S CATHEDRAL, a grandiose structure erected in Petrovsky Square, St. Petersburg, now Leningrad. The building of the cathedral occupied 90 years, from 1768 to 1858. It is constructed of granite and marble in the shape of a Greek cross, and its five gilded domes may be seen from all parts of the city. The fine columns of porphyry, malachite and lapis lazuli and the splendid peristyles of colossal

ST. IVES—ST. JOHN RIVER

red granite monoliths are outstanding features. The paintings in the cathedral represent Russian art for over a century.

ST. IVES, a municipal borough and resort of Cornwall, England, beautifully situated about 317 mi. southwest of London, near the western horn of St. Ives Bay. Traditionally it is named for St. Ia, a virgin disciple of St. Piran, who was martyred in the town in the 5th century. With the advent of railroads, a thriving summer resort sprang up to southward, but the older section still remains picturesque with its devious byways, ancient houses and 15th century parish church. Herring, mackerel, and pilchard fishing still is carried on, although the harbor built in 1767 is silted up and dry at low tides. Pop. 1921, 6,947; 1931, 6,687.

ST. JAMES'S PALACE, formerly the town residence of the British sovereign, on The Mall, London. An irregular brick structure, it was originally erected by Henry VIII (1491-1547), probably after designs by HOLBEIN, and was named from the 12th century Hospital of St. James the Less which formerly occupied the site. Greatly altered in the 17th and 18th centuries, totally destroyed in the southeastern portion by fire in 1809 and considerably realtered in modern times, it was the royal residence from 1691 until 1837, when BUCKINGHAM PALACE was chosen by Queen Victoria. The royal *levées* continue to be given there, and the British court is still officially "the Court of St. James."

Of special interest at St. James's Palace (which now contains the Lord Chamberlain's office, the apartments of various officials of the Royal Household, and the headquarters of the Honourable Court of Gentlemen-at-Arms and of His Majesty's Bodyguard of Yeomen of the Guard) are the Tudor Clock Tower, the Chapel Royal with a coffered ceiling perhaps painted by Holbein, York House, the Prince of Wales's residence, and the various state apartments, mostly of the 17th century.

ST. JAMES'S PARK, in London, England, a handsome public park of 93 acres, between ST. JAMES'S PALACE and the Green Park. Originally only marshy land, the open space was drained and enclosed by Henry VIII, who used it as a deer park and athletic ground. Charles II extended the park and laid it out as a pleasure garden. In 1827-29 the architect John Nash rearranged the grounds and built the "canal" or long lake which leads up to BUCKINGHAM PALACE. "Duck Island," at the east end of the lake, used by Charles II as a duck decoy, is now a breeding-place for waterfowl.

ST. JEAN, a city of St. Jean Co., Quebec, Canada, situated 23 mi. southeast of Montreal, on the Richelieu River which affords waterways to New York and Canadian points over the Hudson and St. Lawrence rivers and Lake Champlain. Served also by six railroads, there is a considerable trade in lumber, grain and farm produce, and in products of local manufactures which include those of sewing machine, hair felt, electrical equipment and pottery factories, also

silk, planing and knitting mills. Pop. 1921, 7,734; 1931, 11,256.

ST. JEROME, a town of Terrebonne Co., Quebec, Canada, situated 33 mi. northwest of Montreal, on the North River, or Rivière du Nord, and the Canadian National and Canadian Pacific railroads. At the center of a lumbering and farming country, and supplied by hydroelectric power, St. Jerome contains many industries, including creameries, planing, paper, pulp and grist mills; rubber, woolen and wood products factories. Pop. 1921, 5,491; 1931, 8,967.

ST. JOHN, the county seat of St. John Co., New Brunswick, Canada, occupying 21 sq. mi. at the mouth of St. John River on the Bay of Fundy, 68 mi. southeast of Fredericton and 481 mi. east of Montreal. With its all-year round harbor a distributing center for considerable fisheries and for a rich agricultural and timber district, it also trades in cattle and dairy produce. In 1930 St. John did an export trade valued at \$40,950,000 and an import trade at \$16,586,000. Manufactures include sugar, textiles, brushes and brooms, pulp and paper, valves and metal products and confectionery. There are also shipbuilding and repairing yards. The St. John dry-docks are 1,150 ft. long. The spandrel arch bridge is said to be the longest in the world. St. John is on the Canadian National Railway, is the Atlantic terminus of the Canadian Pacific Railway, and harbors a large coastwise and transatlantic fleet. Having suffered by fire, the most severe being in 1877, the pleasant and well laid out residential city is largely modern. There are, however, some fine old buildings, and many public works, schools, churches, seven parks and an airport; a sea-plane base is nearby. The Reversing Falls attracts many visitors yearly. The site, originally visited in 1604 by Sieur de Monts, was, until the British advent in 1758, the French trading post of Ft. St. Jean. It was incorporated by royal charter on May 17, 1785. Pop. 1921, 47,166; 1931, 47,514.

ST. JOHN RIVER, the principal river of New Brunswick, Canada, formed by the junction of the Daaquam and Woolastauquaquam rivers on the northern border of Somerset Co., Maine. The St. John flows northeastward to the northern border line of Maine, turns eastward, forming the boundary between that state and Canada, then changes its course to southeast through New Brunswick. After a course of about 500 mi. it empties into the Bay of Fundy. Of its tributaries the most important are the Allagash and the Aroostook. The upper reaches of this river wind through a wild and sparsely populated forest region, but as the stream progresses into New Brunswick it expands considerably in width and is marked by islands and bay-like tributaries such as Grand Lake. At its mouth it contracts to 400 ft. and flows through a rocky gorge over a descent of 17 ft. At low tide the river here is 12 ft. higher than the level of the harbor and at high tide 5 ft. lower, a phenomenon reversing the rapids with every turn of the tide. The St. John is navigable to Grand Falls, 225 mi., where there is a fall of 75 ft.

ST. JOHNS, the capital and principal commercial center and port of Newfoundland. It is located on the eastern coast of Avalon peninsula, 60 mi. north of Cape Race, and about 550 mi. northeast of Halifax, N.S. Essentially a maritime city, and having an excellent land-locked harbor, St. Johns' commerce is chiefly concerned with the fishing industry, and with exporting the catch of the fishing fleet. Forests supplying paper mills, hydroelectricity, and iron, lead and zinc, are among other natural resources the products of which are exported. St. Johns occupies the most easterly site on the American continent, and is picturesquely situated on low hills, with warehouses, factories and docks fringing the shore. Swept by fire three times in the last century, little remains of the ancient city, but among fine modern buildings are the Anglican and Catholic cathedrals, Houses of Parliament, Court House and other public edifices. St. Johns was settled in the early 16th century by fishermen from England. During the American Revolution and the War of 1812 the British fleet made it their headquarters. It was incorporated in 1850. Pop. 1921, 36,444; est. pop. 1931, 42,000.

ST.-JOHN'S-BREAD, a name given to the long, flat, edible pods of the CAROB tree, a native of the Mediterranean region, known also as algaroba.

ST. JOHNSBURY, a village of northeastern Vermont, in Caledonia Co. It is situated about 35 mi. northeast of Montpelier on the Passumpsic River. Three railroads and bus lines provide transportation. The Fairbanks scale, invented in this village in 1830, is manufactured here. St. Johnsbury also has the largest maple-sugar plant in the United States. St. Johnsbury was settled in 1787 and incorporated as a village in 1853. Pop. 1920, 7,164; 1930, 7,920.

ST.-JOHN'S-LILY, a name sometimes applied to the SWAMP LILY (*Crinum americanum*) of the southern United States, occasionally planted for its handsome white flowers.

ST. JOHN'S RIVER, the principal river of Florida, issuing from swamps in Osceola and Brevard counties in east central Florida. It flows northward at a distance of about 20 mi. inland from the Atlantic coast, and after a course of 400 mi. empties into the Atlantic Ocean in Duval Co. Midway in its course the river expands into Lake George and upon issuing therefrom takes the form of a lagoon varying from 1 to 5 mi. in width. Its basin is low, level country containing many lakes and overgrown with semi-tropical vegetation making the region one of the scenic attractions of Florida. Small steamboats can ascend the river 230 mi. to Enterprise and large boats to Jacksonville. The river has been dredged to Jacksonville creating a channel 18 ft. deep.

ST.-JOHN'S-WORT, a numerous genus (*Hypericum*) of herbs and shrubs of the garcinia family, several of which are grown in gardens for their attractive flowers. There are about 220 species, natives chiefly of the Northern Hemisphere, of which some 35 are found in North America. They are mostly erect herbs with opposite entire leaves dotted

with pellucid glands and usually yellow flowers in showy clusters. Those grown for ornament are mostly small shrubs as the shrubby St.-John's-wort (*H. proli-ficum*), Kalm's St.-John's-wort (*H. Kalmianum*),



COMMON ST.-JOHN'S-WORT

Flowering branch, with flowers showing characteristic dots near the margin of the petals

Aaron's-beard (*H. calycinum*) and the gold-flower (*H. Moserianum*). The common St.-John's-wort (*H. perforatum*) is often a troublesome weed.

ST. JOSEPH, a port city in southwestern Michigan, the county seat of Berrien Co., situated on Lake Michigan, at the mouth of the St. Joseph River, opposite Benton Harbor. Airplanes, lake steamers, bus and truck lines and three railroads afford transportation. St. Joseph is in the center of a rich fruit-growing region which yields chiefly berries, peaches, apples and melons. The city has washing machine and hosiery factories, and iron casting works. The site was visited by Pere Marquette in 1669. La Salle built a fort here about 1679. Permanent settlers came in 1829, and the city received a charter in 1891. Pop. 1920, 7,251; 1930, 8,349.

ST. JOSEPH, a city in northwestern Missouri, the county seat of Buchanan Co., situated on the Missouri River, 60 mi. northwest of Kansas City. Six railroads, bus and truck lines, airplanes and small river craft serve the city. It is a port of the Chicago-Dallas airway, and also an important manufacturing and commercial center. The city has structural iron foundries, writing tablet factories, one of the largest pancake flour factories in the world and various other industrial plants; also meat packing houses and great stock yards. In 1929 the manufactures reached a total of about \$50,000,000; the retail trade amounted to \$45,340,351. The surrounding country produces grain and fruit. Joseph Robidoux came here about 1826, when the site was known as Blacksnake Hills. In 1843 Robidoux laid out the town and named it St. Joseph. The city was chartered in 1851. In 1860 the Pony Express was established with its eastern terminus at St. Joseph. Pop. 1920, 77,939; 1930, 80,935.

ST. JOSEPH RIVER, a stream of Michigan, rising in Hillsdale Co. on the southern border of the state. Its course runs in two large curves, the first to the north taking it into Calhoun Co., and the second to the south by which it makes a detour into Indiana. The river empties into Lake Michigan at St. Joseph,

just below Benton Harbor. It is 250 mi. long and navigable for small steamboats 100 mi. to South Ben. Ind. Agriculture is the chief industry in its basin.

SAINT-JUST, ANTOINE LOUIS LÉON DE REICHEBOURG DE (1767-94), French revolutionist, was born Aug. 25, 1767, at Decize, France. Influenced by Rousseau, he became a fanatical believer in social equality. He was elected to the National Convention in 1792 and made his first political speech on the condemnation of Louis XVI on Nov. 13 of that year. After going as deputy on missions to the armies and to different frontiers he became a member of the Committee of Public Safety in 1793. He was an intimate associate of Robespierre with whom and Couthon he formed a sort of a triumvirate in promoting the Reign of Terror. In July 1794 the triumvirate was itself overthrown, and Saint-Just, with Robespierre, Couthon and about 80 of their group, was guillotined on July 28, 1794.

ST. LAWRENCE, GULF OF, an inlet of the North Atlantic extending eastward from the mouth of the St. Lawrence estuary for a distance of about 500 mi. It washes the island of Newfoundland and also Quebec, New Brunswick and Nova Scotia. The Gulf has three channels which enter the Atlantic: Cabot Strait, between Newfoundland and Cape Breton, about 75 mi. wide and having the island of St. Paul in the middle; the Strait of Belle Isle, between Newfoundland and Labrador; and the Strait of Canso, between Cape Breton and Nova Scotia. Besides Prince Edward Island, the Magdalen Islands and Anticosti, the gulf contains many smaller islands, which are dangerous to shipping because of fogs and uncertain currents. The gulf and adjacent coast are celebrated for their fishing grounds.

ST. LAWRENCE ISLANDS PARK, a Canadian national park, in the Province of Ontario, established Sept. 20, 1904 and November 3, 1905, and having an area of 180 acres. The park comprises thirteen islands between Brockville and Kingston in the Thousand Islands region of the St. Lawrence River and a mainland reservation at Mallorytown Landing. The islands, beautifully wooded and well cared for, appear more like town parks than natural areas. The park is equipped for use of summer campers and for general outdoor recreation.

ST. LAWRENCE RIVER, a river of North America, and with the Great Lakes one of the great waterways of the world. It has a length of 2,100 mi. from the source of the River St. Louis, which falls into the head of Lake Superior, to Cape Gaspe on the Gulf of St. Lawrence, but ordinarily the name of the river is applied only to the 750 mi. between Lake Ontario and the Gulf of St. Lawrence. It drains a large portion of North America, and the amount of water carried to the ocean is exceeded by no other river except the Amazon. Seldom less than two mi. in width, the St. Lawrence is $2\frac{1}{2}$ mi. wide where it issues from Ontario, and with several expansions which deserve the name of lake, becomes about 90 mi. in width at the point where it ceases to be con-

sidered a river. The influence of the tide is felt as far inland as Lake St. Peter, about 100 mi. above Quebec and over 500 mi. from the gulf. The river is navigable for ocean-going vessels as far as Montreal, 80 mi. farther inland. Rapids impede navigation above this point, but canals have been constructed which insure continuous communication to the head of Lake Superior.

Considered strictly as a river, rather than as a system of waterways, the St. Lawrence begins at the point where it flows out of Lake Ontario, and ends at the gulf, a distance of 750 mi. The system commences under the name of the St. Louis, a river which rises on the plateau which also sends forth the Mississippi, and falls into Lake Superior. The St. Mary's River links Lake Superior to Lake Huron. Below Lake Huron, which receives Lake Michigan from the south, the waters of St. Clair River, Lake St. Clair, Detroit River and Lake Erie flow at about the same level until the Niagara River descends to Lake Ontario.

Leaving Kingston at the head of the St. Lawrence, navigation is limited to vessels of 14 ft. draught until Montreal is reached, a distance of 170 mi. The first town below Kingston is Clayton, an American summer resort. From Clayton to Chippewa Bay the river, with its thousands of isles, is very picturesque. The last of The Thousand Islands, called The Three Sisters, breast the current just below Brockville on the Canadian shore, with Morristown on the New York bank nearly opposite. The large lake steamers continue down the river as far as Prescott. They cannot go farther because of rapids, which beyond this point occur at intervals all the way to Montreal. From Montreal to Quebec, a distance of 160 mi., a channel has been dredged to a depth of 30 ft; below Quebec navigation is possible for vessels of any draught.

Canals permitting boats to move upward past some of the rapids were built as early as 1783, and about a century later Canada completed a system of canals giving access to Lake Ontario for vessels of 14 ft. draught. In 1887 Canada also provided a canal of like depth between Lake Ontario and Lake Erie. The channels between the latter lake and Lake Huron, and the channel and canals between Lakes Huron and Superior, built and improved partly by Canada and partly by the United States, have more recently provided for vessels of a draught of 21 to 23 ft. The further deepening of these canals is not difficult. Before the World War, Canada began and has since continued and completed the construction of a new canal between Lakes Erie and Ontario. This passes vessels of a draught of 25 ft. and is so constructed that it can be deepened only by dredging and is known as the new WELLAND CANAL, completed in 1930. It overcomes the obstacle of Niagara Falls on the Canadian side and is the first of a system of canals which has extended the St. Lawrence route as far as the head of Lake Superior.

Some of the river's tributaries are themselves of not-

able size. The largest are the Ottawa and the Saguenay, which flow into the St. Lawrence from the north. The smaller Richelieu and St. Francis come from the south. As a rule the tributary streams run a rough and tortuous course, abounding in rapids and waterfalls that give them beauty and often furnish valuable power. The Great Lakes and the upper part of the river form the boundary between Canada and the United States; the lower river, from a point 60 mi. above Montreal, lies wholly within Canada. The river is international, and on both sides of the border plans have been made for making it more important industrially.

Flowing through so many lakes, the speed of the water is checked, thus causing the deposition, many hundreds of miles from the river mouth, of most of the material in suspension. Consequently the waters are too pure at the mouth of the river to deposit any delta or sandbar. This freshness of the water, the absence of heights to keep off cold prevailing winds, and the coldness of the Labrador current combine to make the river icebound for four months in the year.

ST. LAWRENCE UNIVERSITY, at Canton, N.Y., a coeducational, privately controlled institution chartered in 1856. It is undenominational except for the Theological School which educates ministers for the Universalist Church. It has an endowment of \$4,140,656. The Agricultural School is maintained by appropriation from the State of New York. The library contains 46,488 volumes. In 1930-31 there were 679 students, and a faculty of 54 headed by Pres. Richard E. Sykes.

ST. LOUIS, chief metropolis of the Mississippi Valley, an important port of entry of Missouri and the 7th city in population of the United States, is situated on the west bank of the Mississippi, 17 mi. south of the mouth of the Missouri River. The city, at 38° 38' N. lat. and 90° 15' W. long., has an area of 61.37 sq. mi., and its population in 1920 was 772,897; in 1930, 821,960, an increase of 6.3% over the 1920 census. The foreign-born population, estimated at 12.8%, is predominantly German and Irish. St. Louis is approximately 200 mi. northwest of the confluence of the Ohio with the Mississippi, and 709 mi. north of New Orleans. St. Louis is an independent city, but is surrounded by St. Louis Co. on three sides. The city records an average temperature of 31° F. in January, of 79° F. in July. The average annual precipitation is 37.4 in.

Geographic Setting. St. Louis was first settled along rolling ground on the west bank of the river; in the days before the railroad, its location made St. Louis a great river port of the Central Plains. As surrounding territory was settled and turned into farm lands, St. Louis became a market for farm products and a distributing center for eastern manufactured goods.

The average altitude of the city is 473 ft. above sea level. The main business and shopping sections are near the river; the residential districts spread out to the north, west and south, while across the river

to the east the city of East St. Louis has been built. The ridges and uplands which lie back from the river are cut by shallow depressions forming convenient approaches for railroads from the west, and providing sites for lumberyards, stockyards, factories and elevators. The river front is some 20 mi. long, of which the central strip, 4 mi. in length, comprises the levee district celebrated in Mississippi steamboat days.

Streets and Buildings. The streets in the older part of St. Louis were laid out at right angles and parallel to the Mississippi, which bends around the city in a generally north to southwest direction. As the city expanded, new streets west of the river front were laid down to conform in relation to the old streets. In more modern times streets, notably in the southern part of St. Louis, have been laid out in relation to the direct points of the compass. The result is fairly confusing to visitors. The old section, between 4th Street, which runs parallel to the river, and the Mississippi, is a huddle of narrow streets, crowded with warehouses, wholesale establishments and wharves. The elevated district extending west from 4th Street to 14th Street, and bounded north and south by Morgan and Market streets, respectively, is given to skyscrapers. Market Street divides the city north and south. Traversing the skyscraper district west to east are Washington Avenue and Olive Street, both lined with large business establishments. The Memorial Plaza has been designed to extend from Market to Chestnut streets and 12th Boulevard to 15th Street, a \$6,000,000-project which will abolish certain traffic problems and greatly improve the appearance of downtown St. Louis. On the east side of the plaza is the new Court House, erected at a cost of \$4,000,000; at the south end is the City Hall, and the Municipal Auditorium, under construction in 1931; on the west side is the Public Library, and three public buildings, including a Soldiers' Memorial to cost \$1,000,000, which will be erected at the north end. Immediately west of the downtown district is the old residential district, now given over to the Negro and foreign quarter. The chief industrial section extends from the levee district south for 5 mi., on both sides of South Broadway. At the extreme southern end of St. Louis is Carondelet, a second industrial section, which has large grain elevators. The North Broadway industrial section extends along the river front northward from Market Street. St. Louis has a total of 1,007 mi. of streets. Impressive buildings, in addition to the public structures mentioned, include the Union Station, the Art Museum and Jefferson Memorial in Forest Park, and in the business district, the Mercantile Trust, Railway Exchange, Southwestern Bell Telephone and the Federal Reserve buildings.

Parks. St. Louis maintains 65 parks, covering an area of 2,413.93 acres. The largest is Forest Park occupying 1,380 acres in the west central section, in which is located the City Art Museum, on Art Hill, the Jefferson Memorial, Field House, Municipal

Open-Air Theater, the St. Louis Zoo and two golf courses. The Missouri Botanical Garden, widely known as Shaw's Garden from its donor, Henry Shaw, occupies 75 acres containing what has been called the largest collection of plant life in the western hemisphere.

Education. St. Louis has long been an educational center. The first public kindergarten and first public training school for kindergarten teachers were founded here in 1873. The public school system is extensive. In addition to the two large universities, ST. LOUIS UNIVERSITY and WASHINGTON UNIVERSITY, there are several denominational colleges and theological seminaries.

Transportation. A line of steel barges operating between St. Louis and New Orleans established by the Federal Government has led to a revival of river traffic. In recent years there has been a direct export trade via New Orleans with Mexico, Central and South America; St. Louis has service south to New Orleans throughout the year and north to Minneapolis 8 months of the year. Twenty railroads enter the city from the east by way of three Mississippi bridges, one of which, the Eads Bridge, leads into a tunnel under the retail district, giving access to the Union Terminal; seven railroads enter the city from the west, also using the Union Terminal, which with its elaborate system of freight and passenger facilities has been declared the most complete terminal in existence. St. Louis is the second largest railway center of the country. The city is an important station in the airways network of the nation; the \$3,000,000 municipal airport is at Anglum, St. Louis Co.; four large flying schools are located here. Within the city transportation is provided by 465 mi. of street railways and by buses.

Industry and Commerce. The nearness of St. Louis to the Illinois coal fields and to other raw materials, combined with the availability of co-ordinated electric power, has given the city high rank among the industrial centers in the United States. Sources of the city's electric power are steam plants, the Bagnell Dam on the Osage River in Missouri, and the Keokuk Dam on the Mississippi at Keokuk, Ia., all inter-connected. In 1929 the factories numbered 2,704 and produced goods valued at \$983,823,009; the retail trade amounted to \$471,950,609; the wholesale trade proper, to \$655,629,357. In 1930 St. Louis had a wholesale trade worth approximately \$1,356,400,748. The most important manufactures are shoes, steel furnaces, stoves and ranges, sugar mill machinery, woodenware, railroad and street cars, tobacco, feed, drugs, chemicals, automobiles, brick, barbers' supplies, hardware, furs, coffins, lumber, millinery, clothing, open hearth steel castings, iron and steel, enameled ware, wire rope, underground cable, airplanes and parts, motors and electrical equipment, electric fans, glass bottles, white lead, bolts, nuts, woodworking machinery and piston rings.

History. St. Louis was founded in 1764 by Auguste Chouteau and a company of 30 French

pioneers on a site selected the year previously by the engineer, Pierre Laclède. French and Spanish expeditions shortly followed, and the settlement started to grow. In three years' time the St. Louis colonists, organized into the St. Louis Missouri Fur Co., with trading contacts with 28 Indian nations, had a monopoly on the fur trade of the region. In five years the trade amounted to \$80,000 annually, a basis for the future prosperity of the city. In the early days of the opening up of the west, St. Louis was the starting point of all expeditions over the plains, one of them the Lewis and Clark expedition of 1804. In 1770 the Spanish took control of the settlement as a part of Spanish Upper Louisiana, but on Mar. 10, 1804, through the Louisiana Purchase, it came into possession of the United States. The first territorial General Assembly of Missouri met in St. Louis in 1812. In 1822 it received a city charter in the newly admitted state of Missouri. Following 1811, when the first river steamboat made its way up the Mississippi, St. Louis became an important shipping center and continued as one until 1860. After the Civil War, during which St. Louis's sympathies were Unionist, the railroads almost entirely superseded river traffic. From 1870 onward, however, the city's industrial growth was uninterrupted, and in 1928 it was ranked as the 5th manufacturing city of the United States. In 1903 a world's fair was held in St. Louis to commemorate the acquisition of Louisiana by the United States.

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ST. LOUIS UNIVERSITY, a coeducational institution at St. Louis, Mo., which is controlled by the Society of Jesus. Founded in 1818 by the Rt. Rev. Louis William DuBourg, Bishop of Louisiana, it was transferred to the control of the Jesuits eight years later. It comprises the following divisions: Divinity, Medicine, Law, Philosophy and Science, Dentistry, Commerce and Finance, Education, and the Graduate School. In 1925 eight colleges in the St. Louis district were merged with the university. The grounds and buildings were valued in 1931 at \$5,650,000. The library of 140,000 volumes includes a medical library of 15,000 volumes. In 1930 there were 4,300 students and a faculty of 600, headed by Pres. CHARLES H. CLOUD.

ST. LUCIA, an island of the West Indies, chief of the British Windward Islands group, belonging to Great Britain. It is situated midway between Martinique and St. Vincent and comprises an area of about 230 sq. mi. It is 42 mi. in length and its greatest breadth 12 mi. Like most islands of the West Indies, St. Lucia is of volcanic origin. The surface is rugged and precipitous; pyramid rocks arise from the sea to a height of 4,000 ft. Dense forests cover the greater part of the area, but the valleys and the flatlands are open and are of remarkable fertility. The summits of the mountains are perpetually in mist. The average temperature is 80° F.

Sugar, lime juice and lime oil, coconuts and copra, nutmegs, bananas, molasses, honey, hides, logwood and rum are the articles produced and exported. In 1928 the total values of the island's exports amounted to \$1,000,000. The imports exceeded that figure by about \$250,000. Castries is the chief town and the capital. St. Lucia is believed to have been discovered by Columbus. In the beginning of the 17th century the British attempted to colonize it, but most of the settlers were killed by the Carib natives. Later attempts at settlements on the part of the British were likewise frustrated by the natives. But in 1650 the French were more successful and the island became a scene of repeated struggle between them and the British. Since 1803 it has been a British possession. Pop. 1929, 57,482.

ST. MARK'S CATHEDRAL, in Venice, Italy, is the burial place of the Evangelist Mark, the patron saint of the city whose remains were brought from Alexandria in 829. The cathedral was begun in the 9th century. A fire destroyed the original structure in 976, and reconstruction was begun; but between 1074 and 1094 the Byzantine plans of the present were substituted. The church, in the form of a Greek cross, is 251 ft. long and 170 ft. broad and is adorned with five low domes above. Further alterations in the 12th century enriched the decorations with marble slabs and rich mosaic. Some Gothic touches were added to the exterior in the 15th century with the pinnacles and the metal-sheathed exterior domes.

On the west front is the narthex with porches opening on to the Piazza di San Marco. Over the main entrance are the bronze horses, said to have been brought from Constantinople in 1204. A mosaic of St. Mark by Titian is above the central doorway. In the vestibule are Byzantine mosaics of Old Testament subjects. The interior is low and highly decorated with precious metal, bronze, marble and mosaic. The enameled screen above the main altar, where St. Mark is buried, the Pala D'Oro, is encrusted with jewels and gold and silver. There are many beautiful chapels in St. Mark's, and a fine collection of medieval art objects in the treasury.

ST. MARTIN, an island of the West Indies, situated just south of Anguilla. Shaped like a triangle, St. Martin embraces an area of 38 sq. mi., broken by mountainous surfaces, the highest of which, Paradise Peak, reaches to a height of about 2,000 ft. The coast line is deeply indented and broken up by lagoons. The interior is well watered. St. Martin is almost equally divided between France and Holland, the northern portion, comprising an area of 21 sq. mi. belonging to the former country and the southern portion to the latter. The French section, with Marigot, the chief settlement, forms part of the French Guadeloupe colony; while the Dutch part, with Philipsburg, the chief town, is politically part of the Curaçao colony (*see* GUADELOUPE and CURAÇAO). The chief products of St. Martin are salt, sugar, rum and tobacco. Cattle are also raised. In 1929 the island had a population of 2,180.

ST. MARYS, a city in Auglaize Co., western Ohio, situated on St. Mary's River, 22 mi. southwest of Lima. It is served by two railroads. The region has natural gas and oil wells. The local manufactures are wool, flour, box board, cigars and sundry products. Near by is Lake St. Mary, a pleasure resort. Saint Marys, once a Shawnee Indian village, was a trading post, known as Girty's Town. In 1774 Gen. Anthony Wayne built Ft. St. Marys, and on the same site, in 1812, William Henry Harrison erected Ft. Barbee. St. Marys was plotted in 1823; chartered as a city in 1903. Pop. 1920, 5,679; 1930, 5,433.

ST. MARYS, a borough of Elk Co., northwestern Pennsylvania, situated 130 mi. northeast of Pittsburgh. It is served by two railroads. St. Marys is a shipping market for coal, clay, farm and dairy products, and manufactures electric lamps and carbon products. The borough is built on a plateau of the Allegheny Mountains, a few miles east of the Allegheny National Forest. A Benedictine Academy for Young Ladies is located here. St. Marys was founded in 1842; incorporated in 1847. Pop. 1920, 6,967; 1930, 7,433.

ST. MARY'S COLLEGE, near Oakland, Cal., an institution for men founded in 1863 and conducted by the Brothers of the Christian Schools. It offers courses in arts and sciences, civil engineering, medicine, law, commerce, education and music, and maintains a preparatory school. The productive funds in 1931 amounted to \$405,552. The library contained 21,000 volumes. In 1931-32 there were 624 students and a faculty of 35 headed by Brother Leo, Chancellor.

ST. MIHIEL, BATTLE OF, the first major offensive launched by American troops in the WORLD WAR, and the first demonstration of the offensive qualifications of an American army. Although the United States had declared war in Apr. 1917, Pershing declined to engage his troops in action until the 1st American army was prepared to take over a section of the front, and in consequence the offensive was not launched until Sept. 1918. At that time the Germans held a salient 15 miles deep, running from their trenches east of Verdun south to St. Mihiel, and east to the Moselle. With 15 American and 4 French divisions, Pershing undertook to pinch off this area, which since Sept. 1914 had threatened the line Nancy-Verdun. The attack began with a four-hour bombardment on Sept. 12, and at 8 a.m. the American infantry advanced along the west and southern sides of the salient. On the following day the two attacking forces met at Vigneulles, northeast of St. Mihiel, and on Sept. 14-16 established their new front, which had absorbed the entire salient of 175 square miles. The attack was a masterpiece of military precision. The new position threatened the Metz-Mézières line of German communications.

ST. NAZAIRE, an important French shipbuilding center and a modern seaport located on the estuary of the Loire, department of Loire-Inférieure. During the World War St. Nazaire was turned over as a debarkation base to the Americans, who further de-

veloped its port. A monument has been erected to the landing of the first American troops June 26, 1917. The ships of the Compagnie Générale Transatlantique are built in the St. Nazaire shipyards. Pop. 1931, 40,488.

ST. OLAF COLLEGE, a coeducational institution at Northfield, Minn. It was founded in 1874 by a Norwegian Lutheran minister as St. Olaf's School, an academy; and in 1889 was chartered as a college. Ten years later the institution was officially taken over by the United Norwegian Lutheran Church of America. It consists of a College of Liberal Arts and a School of Music. The productive funds in 1931 amounted to \$873,794. The library contained 31,967 volumes. In 1931-32 there were 884 students and a faculty of 71, headed by Pres. LARS W. BOE.

ST. PAUL, the capital city of Minnesota, a port of entry and the county seat of Ramsey Co., is situated in the southeastern central part of the state. It is just below and east of MINNEAPOLIS, with which it forms the geographic unit known as the "Twin Cities." It is on five Federal highways and is served by nine transcontinental railroads. Additional transportation is afforded by river barges, bridges, traction, bus and trucking lines and an airport. The Mississippi River at this point cuts through a gorge, with banks from 100 to 250 ft. high. One of St. Paul's residential sections, winding along Mississippi Boulevard on the upper terraces, commands magnificent vistas of river scenery. St. Paul records an average temperature in January of 13° F., in July 72° F. The average annual precipitation in the city is 27.2 in.

Splendid transportation facilities have made St. Paul the natural distributing center for the northwest. It is one of the largest millinery and hardware jobbing cities of the United States. In 1931 its wholesale trade was important in groceries, dry goods, furs, shoes and drugs. Its meat-packing and publishing industries are of national importance. The principal manufactures include automobiles, shoes, bakery goods, clothing and refrigerators. Its railroad repair shops keep the machinery of distribution in efficient order. In 1929 the value of the factory output was about \$206,918,164. The same year the retail stores, which did a total business of \$172,143,915, gave full-time employment to 15,315 men and women. In 1930, St. Paul, together with the rest of Ramsey Co., had a wholesale trade valued approximately at \$221,832,557. The Minnesota State Fair, the largest in the country, is held annually at St. Paul.

The outstanding building of the city is the Minnesota State Capitol, designed by Cass Gilbert; it is situated on an eminence west of the central business section. Nearby is the Minnesota Historical Society Building. The city, the see of a Roman Catholic diocese, has one of the finest cathedrals of the country. Another outstanding structure is the St. Paul Public Library, adjoined by the J. J. Hill Reference Library, commemorating the name of JAMES J. HILL, whose

activities in the early railroad history of the country were important. St. Paul is the seat of Hamline University, Macalester College, The College of St. Catherine and College of St. Thomas. The agricultural campus of the University of Minnesota is also at St. Paul.

At first an Indian village, St. Paul was later settled, under the name St. Peter's, by a small group of French colonists who lived by fur trading with the Indians. Ft. Snelling, built about 1819, now a Government military reservation, offered protection to the early settlers. In 1841 the first settlement under the name of St. Paul was organized. In the early days of its history, being at the head of steamboat navigation, the town grew into an important river port. St. Paul became the capital of the territory of Minnesota in 1849 and was incorporated as a city in 1854. Pop. 1920, 234,698; 1930, 271,606.

ST. PAUL'S CATHEDRAL, in London, situated at the top of Ludgate Hill, is London's most prominent building and is so well known that it is sometimes called the parish church of the British Empire. It was begun by Sir Christopher Wren in 1675 and was completed in 1710, its cost being defrayed chiefly by a tax on imported coal and wine. Essentially Gothic, it embodies also many interesting classic elements and details. By far the most conspicuous feature is its great dome rising 336 ft., 225 ft. high on the interior, and 111 ft. in diameter. The cathedral is 515 ft. long, 102 ft. wide, and 225 ft. wide at the transept. Its site was probably occupied as early as 604 by an Anglo-Saxon church, and this early church was succeeded by five others. The noted Old St. Paul's, consecrated in 1240, was damaged by fire in 1561 and handsomely rebuilt by Inigo Jones in 1633-42, but was completely destroyed by the Great Fire of 1666.

Of chief interest in the present cathedral are the various chapels, Grinling Gibbons's carved choir stalls, the Whispering Gallery, the reredos and the crypt. Here are found the busts and tombs of many celebrated Englishmen, including the Duke of Wellington, Lord Nelson, Dr. Johnson, Sir Joshua Reynolds, Landseer, Wren and Earl Kitchener. The extensive repairs begun on the dome in 1913 were completed in 1930.

ST. PETERSBURG, a former name for the city of LENINGRAD, U.S.S.R.

ST. PETERSBURG, a city on the western coast of Florida, Pinellas Co., situated on Tampa Bay, an inlet of the Gulf of Mexico, about 20 mi. southwest of Tampa. Bus lines, steamships and two railroads afford transportation. There are two airports. The city is an attractive winter resort and entertains about 300,000 visitors annually. St. Petersburg is a trade and shipping center for citrus fruits, vegetables and fish, and has important commercial fisheries. In 1929 the retail business amounted to \$24,970,217. The site of the city was visited by both Narvaez and De Soto. St. Petersburg was founded in 1888; incorporated in 1903. Pop. 1920, 14,237; 1930, 40,425.

ST. PETER'S CHURCH (*San Pietro in Vaticano*), the largest Catholic church in the world, located in the Vatican State, Rome, Italy. This celebrated Renaissance basilica occupies the site of an earlier basilica, consecrated by Constantine in 324 and demolished in about 1452 by Pope Nicholas V. The foundation stone of the new St. Peter's was laid by Pope Julius II in 1506. BRAMANTE, the original architect, designed the church in the form of a Greek or equal-armed cross with a vast central dome. His plan was altered, however, by the succeeding architects, RAPHAEL, Giocondo da Verona, Giuliano and Antonio da Sangallo and Baldassare Perruzzi. MICHELANGELO, who was made chief architect in 1546, wisely returned to Bramante's ground plan, and himself designed and began the great dome. Michelangelo (d. 1564) was succeeded by Vignola and Giacomo della Porta, the latter of whom completed the dome in 1590. After 1606, at the request of Paul V, the nave was lengthened to give the church the form of a Latin cross, and the façade was erected by Carlo Maderna. In 1626 the new basilica was finally consecrated.

St. Peter's, with an outside length of 727 ft., occupies an area of 18,100 sq. yds. The dome, 138 ft. in diameter, is 404 ft. high. The church is fronted by the famous Piazza di San Pietro, 365 yds. long, which is partly inclosed by Bernini's semicircular colonnade, made up of 284 Doric columns and dating from 1655-67. The square contains an obelisk, brought from Heliopolis to Rome by Caligula and erected in 1586. It is flanked by two handsome fountains.

Interiorly, St. Peter's is awe-inspiring and almost unbelievable in its vastness. The massive columns, the colored marble of the pavement, the marble incrustations on the walls, the various chapels, monuments, tombs, statues, mosaics and other works of art are overwhelming in their size and richness. The most impressive space is that directly beneath the dome, occupied by the high altar, erected in 1594, above which rises Bernini's elaborate bronze canopy or *baldachino*, added in 1633. Below the altar is the crypt containing St. Peter's sarcophagus, and near the altar is the celebrated bronze statue of the saint. The basilica includes a Sacristy, built in 1775, and the old and new grottoes. See VATICAN.

SAINT-PIERRE, BERNADIN DE (1737-1814), French writer, was born at Le Havre, Jan. 19, 1737. He became an engineer, and was employed in Russia, Poland and Germany; later he was given a government commission in Martinique. His first book was *Voyage à l'Île de France*, 1773. *Études de la Nature*, which made him famous, was not published till 10 years later. PAUL ET VIRGINIE, his masterpiece, appeared in 1787. Inspired by the teaching of Rousseau, it is steeped in the sensibility of its time, though redeemed by a simple style and an appreciation of nature. Saint-Pierre died, at Eragny, Jan. 21, 1814.

ST. PIERRE and MIQUELON ISLANDS, a group of three barren islands off the south coast of

Newfoundland, constituting the last remaining possessions of France in North America. The area of the Miquelon Islands is about 83 sq. mi.; of St. Pierre, 10 sq. mi. The collective population in 1926 was 3,584 of which the majority resided in the town of St. Pierre on the island of that name. The dress and habits of the people are thoroughly French. The town of St. Pierre has a good harbor open all the year round, and is the base of supplies for Newfoundland fishermen and the center of the French Atlantic cod fisheries. It is also the residence of the governor of the islands.

ST. QUENTIN, a city on the Somme River in the department of the Aisne. It has been a cloth manufacturing center since the 10th century. The city is celebrated for three great battles fought here: the first resulted in its capture by the Spaniards in the middle of the 16th century; the second, the repulse of the Germans in 1870; and the third was the Battle of St. Quentin in 1918. The town was occupied by the Germans from Aug. 1914 to Oct. 1918, and was almost completely destroyed. Pop. 1931, 49,448.

SAINT-SAËNS, CHARLES CAMILLE (1835-1921), French music composer, was born at Paris, Oct. 9, 1835. After studying at the Paris Conservatoire he played the organ at St. Merri, in 1858 succeeding Lefébure-Wély as organist of La Madeleine, Paris, where he occupied the bench until 1877. Thereafter he devoted himself to concert, both as organist and pianist, visiting the United States in 1906 and 1915, and to composition. He was an executant of unusual attainments, and his ability in transcribing orchestral scores at sight excited the admiration of WAGNER. Honors in numerous countries were showered upon him, in 1868 he was made Knight of the Legion of Honor, in 1881 he was elected to the French Academy, and in 1913 he was awarded the Grand Croix. Of his twelve operas *Samson and Delila* is his most popular and, with *Henry VIII*, his most meritorious. His fertility in other fields was so great that a catalogue of his works is not feasible, but mention should be made of his five symphonies, five pianoforte concertos, three violin concertos, four symphonic poems and several orchestral suites, the oratorios *Le Déluge* and *Noël*, a number of motets, and a considerable bulk of short works for the pianoforte. Among French composers of the 19th century he occupies a secure position, based on impeccable craftsmanship and sound scholarship. He died in Algiers, Dec. 16, 1921.

SAINTSBURY, GEORGE EDWARD BATEMAN (1845-), English critic, was born at Southampton, Oct. 23, 1845, and educated at Oxford. He entered the teaching profession, later contributing articles of literary criticism to the London periodicals. He was professor of Rhetoric and English Literature at the University of Edinburgh from 1895-1915. Saintsbury is best known as an authority on French literature. Among his works are *A Short History of French Literature*, 1882; *A History of Criticism*, 1900-04; *A History of the French Novel*, 1917-19; *Col-*

lected Essays and Papers, 1924, and *A Consideration of Thackeray*, 1931.

SAINT-SIMON, LOUIS DE ROUVROY, DUC DE (1675-1755), French soldier, diplomat and memoirist, was born at Versailles, Jan. 16, 1675. He early obtained a favorable place at the court of Louis XIV. He joined the army in 1692, but in 1702 resigned his commission. In 1721 Saint-Simon became Ambassador to Spain. The importance of his career lies, however, in the composition of his celebrated *Memoirs*. Living at court, surrounded by quarrels, intrigues, ceremonies, events, he collected a vast amount of intimate information, and wrote many volumes, most of which were not published until long after his death. His pen-portraits were extraordinary, his phrases dramatic, and he was undoubtedly the greatest of modern memoirists. Saint-Simon died in Paris, Mar. 2, 1755.

ST. SOPHIA, a church in Constantinople, founded in 325 by Constantine when he made Byzantium his capital, now a Turkish mosque. After a fire in 532, Justinian rebuilt it on new plans. The finest building material was assembled and marble pillars and valuable objects were taken from many pagan temples. The architects employed Roman and Asiatic building principles. More than 10,000 masons worked 7 years to complete the church which has been able to withstand severe earthquakes.

The exterior, 243 ft. long, is square in shape; the interior is in the form of a Greek cross. A dome 107 ft. in diameter and 180 ft. high is above the central part of the nave, two half domes are over the semi-circular ends. After the Turkish conquest in 1453, St. Sophia was converted into a mosque and four minarets were erected at the corners. Every cross was removed and the beautiful Byzantine mosaic work on the ceiling was whitewashed so that all the human figures would be concealed in accordance with Mohammedan religious belief. In 1848, the Sultan had the whitewash scraped off and the figures covered with gold leaf. A German artist made drawings of the original designs, later published by the Prussian government. St. Sophia is famous for its collection of treasures. The altar is made of molten gold and studded with precious stones and many of the vessels are of solid gold.

ST. SWITHIN'S or **ST. SWUTHUN'S DAY**, July 15. According to an old legend, if it rains on this day, rain will continue for 40 days. St. Swithin, Bishop of Winchester and the patron saint of the cathedral, left a request when dying in 861 that he be buried in the churchyard of the minster. This request was faithfully executed; but 100 years later the monks of Westminster, thinking to honor the saint, voted to remove Swithin's bones to the choir, setting July 15 as the day for the ceremony. The saint caused a heavy rain to fall for 40 days, thus showing his disapproval.

ST. THOMAS, a city and the capital of Elgin Co., a port of entry of Ontario, Canada, situated on Kettle Creek, 8 mi. north of Lake Erie and 18 mi. south of

London. Excellent water power makes it particularly suited to industry, and it is a distributing center for the tobacco and agricultural pursuits of the region, and for the products of local foundries, also of the flour, flax and planing mills. There are numerous schools, churches and public works. St. Thomas was incorporated in 1880. Pop. 1921, 16,026; 1931, 15,430.

ST. THOMAS, COLLEGE OF, a Catholic educational institution for men in St. Paul, Minn., under the direction of the Fathers of Holy Cross. It originated in the Seminary of St. Thomas, opened in 1885, which acquired separate quarters in 1894 as St. Paul Seminary. St. Thomas comprises a military academy of high standing, a preparatory school, college departments of arts and sciences, law, commerce and education, and graduate and summer schools. The grounds and buildings in 1931 were valued at \$905,108. The library contained 15,150 volumes. In 1930-31 there were 610 students in the college division and a faculty of 55, headed by Archbishop Austin Dowling.

ST. VINCENT, an island of the West Indies, belonging to the British group known as the Windward Islands. It is situated about 25 mi. from St. Lucia and has a length of 17 mi. and a maximum breadth of 10 mi. Its area is 150 sq. mi. St. Vincent is crossed by a lofty ridge of summits, the highest of which, Soufrière, attains a height of 3,700 ft. Soufrière is still an active volcano and in 1902 wrought havoc on the island. Cotton is the principal product of St. Vincent and is regarded as the best produced in the British Empire. The island is also famed for the quality of its arrow-root. Copra, sugar, molasses, spices, rum, cocoa and peanuts are also produced. Kingston, on the southwest coast, at the foot of Mt. St. Andrew, is the capital. St. Vincent was discovered by Columbus in 1498 and settled by the British in 1627. Pop. 1929, 51,995.

ST. VITUS' DANCE, another name for CHOREA. During the fourteenth, fifteenth, and sixteenth centuries there were epidemics of a religious dancing mania in Germany, and pilgrimages were made to various shrines in search of relief. That of St. Vitus in Zabern was especially famous, and it is from this shrine the disease chorea obtained its common name.

SAIONJI, KIMMOCHI, PRINCE (1849-), Japanese statesman, was born at Kyoto and adopted into the princely Saionji family. Rising rapidly under the Emperor Meiji (*see* MEIJI TENNO) he held command of an imperial army at the age of 19. After ten years study in France he became Minister to Austria in 1885 and three years later Ambassador at Berlin. On his return to Japan he entered politics, was Minister of Education, member of the Privy Council in 1894, and held the premiership from 1906 to 1908 and again for a short period three years later. He represented Japan at the Paris Peace Conference in 1919. He was the last of the "Genro" or Elder Statesmen.

SAITO, MAKOTO (1858-), Premier of Japan, was born at Iwateken in 1858. At 15 he entered the

Japanese navy and rose to be rear-admiral, a post he held during the Sino-Japanese War. In 1912 he became admiral, after having served in the Cabinet as Minister of the Navy, 1905-06. Retiring from service, Saito was appointed Governor-General of Korea, remaining in this office until 1927 when he was Japanese representative at the Naval Armaments Limitation Conference. When he returned to Tokio he was a Privy Councilor and, in 1929, was again appointed Governor-General of Korea, a position from which he retired in 1931. On May 22, 1932, following the assassination of Premier Tsuyoshi Inukai, Saito was appointed Premier by Emperor Hirohito.

SAKHALIN, an island in the North Pacific, off the coast of Siberia, northwest of Japan. Long and narrow, Sakhalin extends for 580 mi. Russian traders settled in the island in the early part of the 19th century. In 1867 negotiations were entered into by the Russian and Japanese governments for joint occupation of Sakhalin, but the subsequent discovery of coal, and consequent influx of Russian convicts, rendered this arrangement unsatisfactory. Further negotiations ensued, and in 1875 the island was ceded to Russia, Japan receiving the Kurile archipelago in exchange. During the Russo-Japanese war Sakhalin was captured by the Japanese and by the Treaty of Portsmouth, 1905, the southern part (Karafuto)—south of 50° N.—of the island was ceded to Japan, the northern part to Russia. Coal occurs in the south and petroleum in the north. The area of the Japanese portion is 13,926 sq. mi., with a population in 1930 of 295,187; of the Russian portion, the area is 42,610 sq. mi., and the population 52,600.

SAKI, any South American monkey of the long-haired, bushy-tailed, bearded genus *Pithecia*, the habits of which are little known. As captives they are rare and delicate. Of the five or more species, one of the more conspicuous is the cuxio or Satan monkey (*P. satanas*), which has black, shining fur that grows on the head as if carefully brushed aside from a central parting.

SAKIAN, the language of the ancient Iranian Scyths, closely related to SARMATIAN and PARTHIAN, but more nearly akin to AVESTA than to Old Persian. Of the earliest stage little has survived except proper names and some words recorded by classical writers; but in the medieval period Khotan produced a considerable literature, chiefly Buddhist, of which only a small portion has been edited or studied.

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SAKUNTALĀ (*Abhijñāśakuntalā* or *Sakuntalā Recognized*), a pastoral drama in seven acts by KĀLIDĀSA, the great Indian dramatist, dating probably from the 4th or 5th century A.D. Sakuntalā, the daughter of Viśvāmitra and Menaka in Hindu mythology, grows up in a forest, fed by the birds and beasts. One day, while hunting in the forest, King Dushyanta meets Sakuntalā, falls in love with her, marries her, and gives his bride a ring which she must present at court, whither he bids her follow him. But Sakuntalā loses

the ring, is refused at court, and returns sadly to her forest. At last a fisherman who has found the precious ring is brought to court, and Dushyanta, reassured, joyfully sends for Sakuntalā and makes her his queen. The first English translation of this delightful play was made by Sir William Jones, 1789.

SALAD DRESSINGS, consist of three general types: French dressing, a combination of oil and acid with seasonings; mayonnaise, an emulsion of raw eggs, oil, acid, and seasonings; cooked dressing, a custard or white sauce foundation with seasonings. They are used to give piquancy, flavor and succulence to SALADS.

For oil, olive, corn, cottonseed, and other salad oils (*see* OILS AS FOOD PRODUCTS) are used; for acid, vinegar, cider or lemon juice; for seasonings, salt, pepper, sugar, paprika, and mustard. Variations in the flavor and consistency of these basic salad dressings are obtained by substituting or adding other ingredients, such as fruit juices, tarragon, spices, table sauces, cheese, olives, cream, etc.

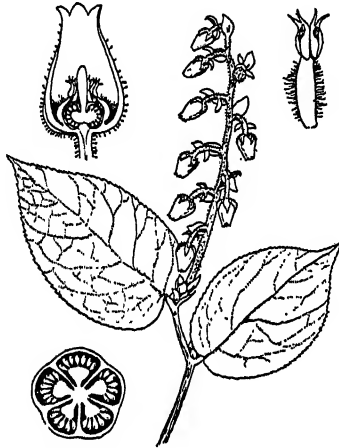
SALADIN (1138-93), a sultan of Egypt who succeeded during his lifetime in holding together the Mohammedan power in the East and turning the tide of the Crusades which theretofore had been favorable to the Christians. Saladin was sent to Egypt in 1164 as a general of the Abbasid caliph at Bagdad. By 1169 he was master of the country. In 1174 he returned to conquer Syria and forced the caliph to grant him the title of Sultan. Saladin now completely surrounded the Christian kingdom. War opened in 1183 and the sultan re-took Jerusalem after 88 years of Christian rule. The fall of Jerusalem immediately fired Europe to the Third Crusade, and the long siege of Acre and the campaigns between Saladin and Richard I of England began. Although Saladin was unable to capture the coast, he retained Jerusalem, only granting the Christians the right of pilgrimage and retention of a church there.

SALAD PLANTS, various plants with tender parts that are used uncooked for human food. They are chiefly comprised in three groups: 1. the bitter salads, which include LETTUCE, CELERY, ENDIVE, CHICORY and DANDELION; 2. the piquant salads, as MUSTARD, garden CRESS, WATER CRESS and NASTURTIUM; 3. the bland or neutral salads, as CORN SALAD and winter PURSLANE. Other plants utilized raw as ingredients of salads are CABBAGE, young onions and radishes. In the United States lettuce in its numerous forms is the principal vegetable used for salad. The cardoon, extensively cultivated in Europe as a salad plant, is rarely grown in America. For further details *see* the articles on ONION, RADISH and other plants mentioned.

SALADS, preparations of meat, fish, chicken, vegetables, fruit, eggs, etc., served alone or in combination on the leaves of a salad green with a dressing. The ingredients used for the body of the salad are cut in distinct pieces, seasoned, and tossed together lightly to prevent mashing. In jellied salads the ingredients are molded in gelatin.

Salads are always served cold. They should be crisp, attractive, and refreshing, with the ingredients thoroughly blended and well seasoned. The simplest salads are made of dressed salad greens, such as lettuce, chicory, water cress, romaine, endive, dandelions, etc. See also SALAD DRESSINGS.

SALAL (*Gaultheria Shallon*), a slender evergreen shrub of the heath family called also shallon. It is common in woods, especially redwood and Douglas



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

SALAL

Longitudinal section of flower, stamen,
cross section of ovary and flowering
branchlet

fir forests, from California to British Columbia. The erect or spreading stems, 1 to 6 ft. high, bear shining finely toothed leaves and long clusters of small white or pinkish flowers. The black, sweet-flavored berry-like fruit, about the size of a common grape, is edible.

SALAMANCA, capital of the Spanish province of the same name about 50 mi. from the Portuguese frontier, situated in an amphitheater on the Tormes River. It has old walls with gates and a fine square arcade. Most noteworthy among the public buildings are the late-Gothic cathedral, and the 12th century Byzantine cathedral, the former Jesuit College in Florentine style, a Gothic university building, 1415-33, the former Dominican abbey with a fine domed church, and the 18th century town hall. The flourishing industry of the Middle Ages has declined and is restricted to tanning and the manufacture of earthenware. The famous old university, founded in the early 13th century, was in its glory in the 16th century. Est. pop. 1929, 32,000.

SALAMANCA, a city in Cattaraugus Co., southwestern New York, situated on the Allegheny River, 52 mi. southeast of Buffalo. It is served by bus lines and three railroads. The countryside is devoted to farming and dairying. Salamanca has furniture and worsted factories and railroad shops. The city is in the Allegheny Indian Reservation, and the property is leased for 99 years by an act of Congress passed

in 1892. It is surrounded by forests. Nearby is the Allegheny State Park. Salamanca was founded in 1815; incorporated in 1879; combined with West Salamanca, it became a city in 1913. Pop. 1920, 9,276; 1930, 9,577.

SALAMANCA, UNIVERSITY OF, the oldest university in Spain, situated at Salamanca. It was founded in 1230 by Alphonso IX of Leon, but was refounded by St. Ferdinand of Castile in 1242. Under the patronage of Alphonso X, 1252-82, it was renowned throughout Europe for its teaching of civil and canon law, being attended in the period of its fame by over 14,000 students annually. It was at Salamanca that Columbus retold the story of his discoveries, and there also the Copernican system was early expounded. After about 1550, however, the university's prestige declined. In 1769-77 a reorganization was effected and again in 1857. The present university enrolls annually about 1,200 students. In 1930 the faculty of 42 members was headed by José M. R. Loscertales, Rector.

SALAMANDER, a name which applies strictly only to the true salamanders (*Salamandra*), but which



SALAMANDER

is given popularly to many other tailed amphibians (*urodeles*), especially those which are more or less lizard-like in appearance.

True salamanders are found in the Old World. As adults they are always terrestrial, although they live in damp places. There are four species, of which the most common is the European yellow-spotted salamander (*Salamandra maculosa*). The female of this species bears her young alive, as aquatic larvæ. She therefore betakes herself to the water for their birth. Another species, the rare black Alpine salamander, is quite emancipated from the water. Here, too, the young are born alive, but they pass through their metamorphosis before birth.

In America there are many tailed amphibians belonging to the same family (*Salamandridæ*) as the true salamanders. The commonest and most interesting is the tiger salamander (see AXOLOTL), which as an adult lives on land in damp places. Others are the blotched salamander (*Amblystoma opacum*) which frequents dry and rocky country, the blue-spotted salamander (*Plethodon glutinosus*) of the mountains, and the dusky salamander (*Desmognathus fusca*) that lives in fast-moving water.

SALAMANDER, a vertical, cylindrical drum open at the top and provided at the base with air passages and a grate for the COMBUSTION OF FUEL; used for warming buildings under construction.

SALAMIS, BATTLE OF (480 B.C.), an engagement fought off the island of Salamis, near Athens,

between the Greek fleet of 365 triremes under THEMISTOCLES and the Persians under XERXES with more than 1,000 triremes and galleys. Through the clever ruse of Themistocles, the larger Persian fleet was put into such a position it could not operate. The Greeks were completely victorious, losing about 40 vessels against the Persian 200 or more.

SALAMMBÔ, a historical novel by GUSTAVE FLAUBERT; published 1862. Salammbô, daughter of Hamilcar and sister of Hannibal, one night steals forth from Carthage and goes to the tent of the common soldier Matho, who has gained command of the revolted mercenaries besieging the city. She gains the end for which she came, recovering the sacred garment of Tanit which Matho has previously stolen and upon which the fate of Carthage depends. The mercenaries are utterly defeated. But Salammbô, in the midst of her wedding, sees Matho, tortured and lacerated almost beyond recognition, and seeing him she dies. Perhaps no other novel has ever achieved such effects of luxury, magnificence and barbaric grandeur.

SAL AMMONIAC, common name for a white crystalline salt of ammonia (ammonium chloride, NH_4Cl), obtained from the ammoniacal water produced in gas works in the washing of the gas. It also occurs as an efflorescence or sublimation in volcanic regions. Sal ammoniac is a colorless, odorless, semi-transparent fibrous substance having a sharp saline taste, rapidly soluble in water. It is used in medicine as a solvent and expectorant, in treating bronchitis, rheumatism, neuralgia, and as a stimulant.

SALANDRA, ANTONIO (1853-), Italian statesman, was born at Troia, Aug. 31, 1853. He graduated from the University of Naples in 1875, taught administrative law at the University of Rome, and in 1886 was elected as a Conservative to the Chamber of Deputies. He was Treasury Minister in 1909-10, and Prime Minister at the outbreak of the World War in Aug. 1914. He maintained that the TRIPLE ALLIANCE bound Italy only in the event of a defensive war, declared Italian neutrality and entered negotiations with the Allies which resulted in the entrance of Italy against Germany and Austria in May 1915. Salandra resigned in 1916. He attended the Versailles conference as an official delegate, and in 1923 represented his country on the Council of the League of Nations. He supported Fascism, and in 1928 was made a senator by Mussolini. *See also* LONDON, TREATY OF.

SALEM, a city in eastern Massachusetts, and a county seat of Essex Co., situated on Salem Harbor, 16 mi. northeast of Boston. It is served by the Boston and Maine Railroad and the Eastern Massachusetts Street Railway. The local manufactures include textiles, lamps, gloves, shoes and leather. In 1929 the retail business reached a total of \$27,598,370. Salem possesses many interesting buildings, among them the Federal Post Office, the Corwin witch house, the Pickering house, built before 1660, THE HOUSE OF THE SEVEN GABLES, Nathaniel Hawthorne's birthplace and the Custom House in which Hawthorne worked

from 1845 to 1849, and which he describes in the introduction to THE SCARLET LETTER.

Roger Conant and a group of colonists made the first settlement here in 1626. In 1628 the New England Council granted a patent to the Dorchester Company and sent John Endicott to Salem as governor. In 1629 the first Congregational Church in America was established in Salem, with Roger Williams as pastor in 1634-35. The settlement became the center, in 1692, of the famous witchcraft delusion; nineteen were hung as witches during that craze. After 1670 Salem was for many years a well-known port of the China-East India trade. Pop. 1920, 42,529; 1930, 43,353.

SALEM, a city and the county seat of Salem Co., N.J., located on the navigable Salem River 32 mi. southwest of Camden. It is served by the Pennsylvania Railroad and bus and trolley lines. Its industries include the manufacturing of glassware, floor-coverings, milk products, women's wear and canning machinery. It is the trading center for a prosperous agricultural area. Settled in 1675 by John Fenwicke, Salem was incorporated as a town in 1695, and received its charter as a city in 1858. Pop. 1920, 7,435; 1930, 8,047.

SALEM, a city of northeastern Ohio located about 20 mi. southwest of Youngstown, on the Youngstown and Ohio and Pennsylvania railroads. It is the center of an agricultural and coal-mining region. The city manufactures automobile bodies, motor boats, electric furnaces, porcelain ware, such as tubs and sinks, and also pumps and pottery. In 1929 the value of the factory output was about \$12,000,000; the retail trade amounted to \$6,831,361. Salem was settled in 1807 and chartered in 1887. Pop. 1920, 10,305; 1930, 10,622.

SALEM, the capital city of Oregon and county seat of Marion Co., is situated at the head of navigation on the east bank of the Willamette River, about 52 mi. south of Portland. Two railroads, busses, airplanes and river craft serve the city. The city is in the center of the Willamette Valley, a rich agricultural region; special crops include English walnuts, hops, Italian prunes, and loganberries. A high quality of long fiber flax is grown. Salem is an industrial center with fruit and berry canning plants, two linen mills, meat packing plants and pulp, paper and lumber mills. The city is also the center for a filbert industry and for Jersey cattle-raising of the Northwest. In 1929 the manufactures were valued approximately at \$15,000,000; the retail trade amounted to \$17,959,907. Salem derives water power from the Santiam, a tributary of the Willamette River. Among state institutions located in the city are a penitentiary, a reform school and an insane asylum. Willamette University is the leading educational institution. Just north of the city at Chermawa, is the Salem School for Indians maintaining a well-equipped hospital. Salem was first settled in 1840 by Methodist missionaries, in 1860 was made the state capital, and was incorporated in 1861. Pop. 1920, 17,679; 1930, 26,266.

SALEM, a town in southwestern Virginia, the county seat of Roanoke Co. It is situated on the Roanoke River, between the Blue Ridge and the Allegheny Mountains, 6 mi. west of Roanoke. The Norfolk and Western and the Virginia railroad and bus lines serve Salem. The town has a tannery, a machine shop and factories making silk, cigarette machinery and trousers. Salem is a summer resort and the seat of Roanoke College, founded 1853. The site was settled in 1802; and Salem incorporated as the county seat in 1836. The vicinity has interesting caverns and medicinal springs. Pop. 1920, 4,159; 1930, 4,833.

SALEM COLLEGE, at Winston-Salem, N.C., a privately controlled college for women, was founded as Salem Academy in 1772. A boarding department was introduced 30 years later, and the institution was chartered as a college in 1866. It is affiliated with the Moravian Church, South, but is non-sectarian. The productive funds in 1931 amounted to \$436,000. The library of 13,287 volumes contains a special collection of text-books printed since 1802. In 1931-32 there were 300 students and a faculty of 39, headed by Pres. H. E. Rondthaler.

SALEM WITCHCRAFT. In Salem, Mass., in 1692, the superstition of witchcraft asserted itself in a wave of emotional hysteria. This was largely invoked by the writings and sermons of Cotton Mather and other ministers, and by the popular belief that evil forces must have been responsible for recent political and military disasters suffered by the Massachusetts Bay Colony. First appearing in Salem Village, now Danvers, where several girls accused certain old women of having bewitched them, the delusion affected the city itself, and prevailed throughout the summer of 1692. Nineteen persons were hanged, and one, Giles Corey, was pressed to death by weights. With the subsidence of the hysteria those awaiting trial for witchcraft were released, and several judges and ministers publicly regretted their part in the persecutions.

SALE OF GOODS, in law a contract between a seller and a buyer whereby the seller in consideration of payment or promise of payment of a fixed price in money transfers to the buyer title and possession of specified personal property. The law of Sales has to do only with sales of personal property. In case of land, the law speaks of the vendor and purchaser and a formal conveyance is required. Also the contract to sell land is governed in many particulars by different rules from those applying to sales of goods. In England the whole subject is covered by the Sale of Goods Act, and in the United States in most jurisdictions by the Uniform Sales Act drawn up under the auspices of the National Conference of Commissioners on Uniform State Laws.

SALERNO, a city of southwestern Italy, capital of the province of the same name, on the Gulf of Salerno. It is the seat of an archbishop. Among the features of architectural interest are the 11th century Cathedral of San Matteo, restored in the 18th

century, containing the tomb of Pope Gregory VII; the 17th century Church of San Giorgio; Sant' Andrea with a belfry of the 12th century; and the ruins of a Lombard citadel. The ancient *Salernum*, Salerno became in 849 capital of a principality belonging to the Frankish and later to the German Empire. The medical school, world famous in the Middle Ages, declined after the 14th century. The modern city has advanced schools, a museum and a library. It produces cotton goods, macaroni and cement and engages in shipbuilding and trade. There is a harbor and sea bathing. Pop. 1931, 63,084.

SALERNO, SCHOOL OF, formerly the oldest medical school in Europe, at Salerno, Italy. This school, which was famous even in the 9th century, had an obscure origin. It attracted students from every quarter of Europe in the 11th century, when Constantine the African lectured there on science, and in the 12th and 13th centuries. It tolerated Jews, and women were among its teachers and students. Its medical system, based largely on the teachings of Hippocrates and Galen, included a considerable knowledge of drugs but practically disregarded anatomy. The school declined gradually after the 14th century and was finally dissolved by Napoleon in 1811.

SALESIAANS, members of the Society of St. Francis de Sales, a teaching congregation in the Catholic Church. To meet the need of Christian education in Italy, where the French Revolution had sown the seeds of atheism, Don (John) Bosco in 1844 undertook the religious training of poor boys around Turin, at gatherings called "Festive Oratories." Night schools were instituted and workshops added for the instruction of young artisans. The formation of a permanent teaching staff gave rise to its organization in 1859 as a religious congregation, the papacy approving rules drawn up by the founder in 1857. With the opening of several colleges, the work of higher education was undertaken. Missions were established in North and South America, Africa, Asia, the Near East and, recently, in Australia. Salesian houses are found in nearly every country of Europe. There are in all 543 establishments in 35 provinces, and about 6,700 religious.

SALESMAN, one whose function it is to present the desirability of a product or service so that another becomes willing to purchase it. Salesmanship has become one of the most important occupations in modern business. Frequently using the mails to approach a possible customer, and often selling by the same means, salesmanship is usually most effective when personal contact with a customer has been brought about. A salesman should have sufficient confidence in himself and in his goods so that he will not become discouraged by failure, and he must have enough intelligence to present his proposal in a logical persuasive and acceptable manner. He should be possessed of a pleasing yet strong personality, and must be able to talk with men in all walks of life. To-day he depends less upon aggressiveness than

upon a thorough understanding of his customer's needs and a full knowledge of his own product. Successful salesmanship is one of the best apprenticeships for a larger business career.

R. PL.

SALESMANSHIP, the art practiced by the seller in inducing customers to purchase goods or services; in popular language any attempt to influence others by suggestion, persuasion or argument. Salesmanship plays an important part in modern business. It is estimated that there are approximately 2,000,000 salesmen and saleswomen in the United States and that the annual expenditure for personal salesmanship is probably not less than \$3,000,000,000. This development is relatively recent. Salesmanship has been practiced since the beginning of trade, but not until the advent of the **FACTORY SYSTEM** and the development of large-scale manufacturing made necessary mass distribution did salesmanship assume its present importance. The last quarter of a century has witnessed a steadily growing interest in the improvement of selling methods. Numerous attempts have been made to present in systematic form the principles to be followed in effective selling. The most widely known formula is based upon the psychological steps of attention, interest, desire, confidence, decision, action, satisfaction, which have been presented as representing the mental journey of the typical customer in the sale. There is at present a tendency to break away from this formula and to base the analysis of the sale upon a study of the customer's wants. This is in line with the trend away from the predatory theory of exploitation which has characterized much selling in the past, toward the idea that the objective selling is to secure satisfied customers who will buy again and again. See **SALESMAN**.

H. K. N.

SALES TAX, a form of **TAXATION** in which the object of taxation is the proceeds from the sale of one or more kinds of property. Such taxes may be general or specific. A general sales tax applies to all sales of commodities or property, including some classes of services such as transportation and the use of hotel rooms. Specific sales taxes apply to the sales of particular articles such as tobacco, gasoline or cosmetics.

The usual argument for the general sales tax is based on its productivity and its universality. The immense volume of gross turnover stands out conspicuously, and computations of the tax yield at even quite moderate rates are a strong temptation to a government with an empty treasury and a weak tax administration. On the surface, also, such a tax reaches everyone.

The chief defects of a general sales tax are, first, its indirect character, which means that the tax is often concealed in the price so that the taxpayer is unaware of paying it; second, its incidence, which is ordinarily heavier on those with small taxable capacity; third, its different effects on integrated and non-integrated industries; and fourth, its administrative problems, which have sometimes proved more serious than was at first apparent.

The most important specific sales tax is that on gasoline. This tax is easily and cheaply collected, and as long as the revenue is used for highway purposes there is a direct relation of tax to benefit which goes far to quiet opposition.

H. L. L.

BIBLIOGRAPHY.—National Industrial Conference Board, *General Sales or Turnover Taxes*.

SALFORD, a city of Lancashire, England, virtually part of Manchester, from which it is separated by the River Irwell. The two cities are connected by many bridges and several railroad viaducts. Both boroughs were enfranchised in 1832, Manchester returning two and Salford one member to Parliament. An act of 1867 gave Manchester three and Salford two members, and that of 1885 six and three members respectively.

Salford is entirely a modern city, a product of the industrial revolution of the 18th century, and was transformed from a quiet village into a manufacturing center. Steam, the flying shuttle and the spinning jenny provided the means for the production of large quantities of clothing. Cheap coal from adjacent mines encouraged engineering as well as cotton manufacturing. With its fine docks the city has become a large distributing agency for overseas products, as well as an exporting center for the north of England. Two-thirds of the entire cotton manufactures of Britain are located in Manchester and Salford. The city has four beautiful parks and a splendid educational system. Pop. 1921, 234,045; 1931, 223,442.

SALIAH or **SHELAH**, according to the **BOOK OF GENESIS**, represents two early Biblical characters: (1) the son of Arpachshad (see **ARPHAXAD**) and the father of Eber (10:24), or as the Septuagint records, the grandson of Arpachshad, and (2) the youngest son of Judah by Shua' (38:5) who gave his name to the family of the Shelanites. Aside from indications that some modern students would classify him among legendary clans of the early Hebrews, nothing has been learned regarding him.

SALIC LAW, a compilation of the laws and customs of the Franks made about the 6th century under the direction of King **CLOVIS**, published for the first time in Latin. Later kings, especially **CHARLEMAGNE** and Louis the Pious are known to have made extensive amendments to the code. Although primarily a penal code certain chapters of the Salic Law relate to civil affairs. The most famous chapter, perhaps, is that which prohibits daughters from inheriting land, or women succeeding to the kingship.

SALICYLIC ACID, an organic acid which occurs naturally, usually as methyl salicylate or oil of wintergreen, in a number of plants, notably sweet birch and wintergreen. It is used principally in the manufacture of sodium salicylate and such other salts as methyl salicylate, **ACETYL SALICYLIC ACID** or aspirin, salol, and theobromine sodium salicylate.

In certain countries, salicylic acid is employed as a preservative for foods and beverages, though in the United States this is illegal. About 500,000 pounds of sodium salicylate are used annually in the United

States, mainly for medicinal purposes, and great amount is consumed in the manufacture of aspirin.

Medicinally, salicylic acid finds wide use as an ingredient in antiseptic solutions and as an application in various forms of skin diseases. It is also the active ingredient in many so-called corn removers, because of its keratolytic properties. Compounds of salicylic acid also find wide use in medicine—such as *methyl salicylate* (oil of wintergreen) which is used as a flavoring and in treatment of rheumatism. *Sodium salicylate* is the most widely used salt of salicylic acid and is used extensively for the relief of pain in acute rheumatic fever and for allaying neuralgic pain and headaches. It is a feeble antiseptic. E. H. V.; P. N. L.

SALIDA, a city in Chaffee Co. in southwestern central Colorado. It is situated on the Arkansas River, in the Rocky Mountains, 80 mi. northwest of Pueblo. It is served by the Denver and Rio Grande Western Railroad. The rich mineral fields nearby yield gold, silver, lead, copper and various other products. The region is also agricultural; dairying, stockraising and certified seed-farming being the chief interests. The city has railroad shops and granite and creosoting works. It is surrounded by valuable tracts of forest under government control. Salida was founded and incorporated in 1880. Pop. 1920, 4,689; 1930, 5,065.

SALIENT, any forward projection in a separate work or in a defensive line. It is dangerous to defenders on account of susceptibility of attack on more than one side, and also to the attackers from the enfilading fire it permits along continuous fronts. Any defensive line consists of a series of salients and reentrants.

SALINA, a city in central Kansas, the county seat of Saline Co., situated on the Smoky Hill River, 187 mi. west of Kansas City. Bus and truck lines and four railroads afford transportation. There is an airport. The city lies in a rich grain-growing region. The chief industrial activities are flour milling, meat packing, iron foundry and machine shop work and the manufacturing of farm implements and mattresses. In 1929 the factory output was valued at \$19,033,273; the retail trade amounted to \$17,369,656. Kansas Wesleyan University and St. John's Military School are located here. Salina was settled in 1858 and chartered in 1870. Pop. 1920, 15,085; 1930, 20,155.

SALINAS, a city in western California, the county seat of Monterey Co., situated on the Salinas River, 110 mi. southeast of San Francisco. It is served by buses and the Southern Pacific Railroad. There is an airport. Salinas lies in the beautiful and fertile Salinas Valley between the Santa Lucia and Gabilan mountains. The region produces many crops, chiefly lettuce, of which 9,000 carloads are shipped annually. Guayule rubber is also grown. There is a large beet sugar factory near the city. The retail trade in 1929 amounted to \$11,136,764. The site of Salinas was settled in 1858 and the city was incorporated in 1874. Pop. 1920, 4,308; 1930, 10,263.

SALISBURY, ROBERT ARTHUR, 3rd Marquis of (1830-1903), English Conservative statesman, was

born at Hatfield, Feb. 3, 1830. Educated at Eton and Oxford, he was elected to parliament in 1853. After his marriage in 1867 he did journalistic work, writing excellent political articles. On the death of his elder brother he became Lord Cranborne and was appointed secretary of state for India, but after seven months resigned. He succeeded to his father's title in 1868 and a year later was made chancellor of Oxford University. In 1874 he again became secretary of state for India in Disraeli's ministry, went to Constantinople as the representative of Great Britain in a conference on the Eastern Question, was made foreign secretary in 1878 and delegate with Lord Beaconsfield to the Congress of Berlin. After the death of Disraeli in 1880, he succeeded him in the leadership of the party. When Gladstone resigned in 1885, Lord Salisbury succeeded him as prime minister holding that office in four different ministries. During the first and the greater part of the second and third he was also foreign secretary. In general, events were more exciting abroad than in England in the years Salisbury was in office. He admired Germany but suspected her, especially after William II dismissed Bismarck. When Lord Salisbury retired in 1902 the Conservatives lost ground and much that he sought to avoid came to pass. He died at Hatfield, Aug. 22, 1903. W. C. L.

SALISBURY, a city and municipal borough of Wiltshire, England, situated on the Avon River, about 85 mi. southwest of London. It is an ancient town noted for its cathedral (*see SALISBURY CATHEDRAL*) and interesting medieval buildings. In the vicinity are remains of the extinct city of Old Sarum which was an important center in Saxon times and in the 11th century was the seat of a bishopric. Six miles north of Salisbury is STONEHENGE, the ruins of a great prehistoric structure dating probably from the Bronze Age. In the Blackmore Museum at Salisbury is a valuable collection of primitive implements which were found in the surrounding Salisbury Plain. Pop. 1921, 24,904; 1931, 26,456.

SALISBURY, the capital of Southern Rhodesia, situated in the Mashonaland plateau, 4,880 ft. above sea level, 250 mi. northeast of Bulawayo and 374 mi. from the port of Beira. *See RHODESIA*. The town is laid out on modern lines, has modern conveniences, and is becoming an important industrial center for the preparation of tobacco, leather and other products depending on the local supplies of raw material. When the Sinois-Kafue railroad is completed Salisbury may become more important, as it will be on the direct route from Beira to Katanga. Pop. 1927, about 22,000; white pop., 8,045.

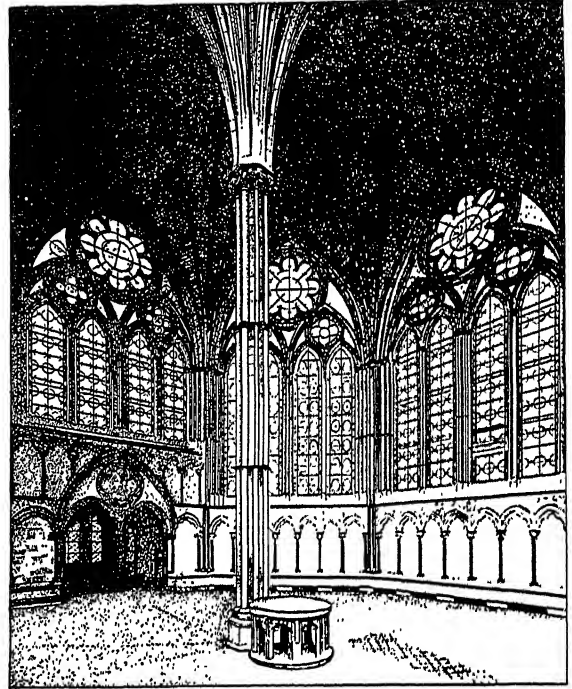
SALISBURY, a city in southeastern Maryland, county seat of Wicomico Co., situated on the Pennsylvania Railroad, about 90 mi. southeast of Baltimore. Salisbury is located in an agricultural and timber-growing region; its manufactures include wooden boxes and other wood products, flour and fertilizer. Wool carding and canning are carried on. The retail trade in 1929 amounted to \$8,783,959.

Salisbury was founded in 1732 and incorporated in 1812. Pop. 1920, 7,553; 1930, 10,997.

SALISBURY, a city in western North Carolina, county seat of Rowan Co., situated near the Yodkin River, 39 mi. southeast of Winston-Salem. Two railroads, bus lines and an airport serve the city. Salisbury is a railroad transfer point and a manufacturing center producing textiles, flour and feed. In 1929 the value of the manufactures was about \$7,000,000; the retail trade amounted to \$8,708,596. Cotton, wheat and corn are the chief crops of the vicinity. In the neighborhood are many spots of historical interest, such as Daniel Boone Cave, Old Stone House erected in 1766, and Trading Ford where Gen. Nathanael Greene evaded Lord Cornwallis during the American Revolution. There is a national cemetery in which 11,700 federal prisoners of the Civil War are buried. Salisbury was founded in 1775. Pop. 1920, 13,884; 1930, 16,951.

SALISBURY CATHEDRAL, celebrated alike for its exquisite situation, its beautiful central spire, the highest in England, and for the symmetry of its design, in external effect is rivaled among the English cathedrals only by LINCOLN CATHEDRAL. Its plan is more uniform than that of most of the great churches of England. In architectural detail the main body of Salisbury is pure Early English, virtually untouched

the least satisfactory feature of the church; Francis Bond, lamenting its being "tacked on" to so superb a cathedral, calls it the "worst façade in England." The decorated Gothic cloister was probably built about 1270, and somewhat later was erected the handsome chapter house, noted for its carvings. The



CHAPTER HOUSE OF SALISBURY CATHEDRAL, ENGLAND
View showing three of the building's eight sides



SALISBURY CATHEDRAL, WEST FRONT

by foreign influence. It was completed, save for the west front, the top of the tower and the spire, in 38 years (1220-58). The interior is simple and effective, though it suffers from a lack of stained glass in its many windows and from the bareness resulting from James Wyatt's restoration in 1778-79. The lady chapel, which completes the square east end, is a notable example of the Lancet style. The nave contains several interesting monuments, the best being those of Sir John Cheney (d. 1509), standard bearer to Henry VII at Bosworth Field, and of William Longespee, 3rd Earl of Salisbury, who died in the Holy Land in 1226. The west front of Salisbury is

famous spire of Salisbury, 404 ft. high, was added in 1350 to the central tower.

SALISBURY PLAIN, a hilly district between Salisbury and Devizes in England, about 20 mi. long and 14 mi. wide. The land is of a chalky formation, similar to the country in central and southern England.

SALISH, an important tribe of the North American Indian Salishan linguistic stock from which it was named. They occupied a large section of western Montana around Flathead Lake and Valley. They have popularly been called Flathead, but unlike many of the surrounding tribes they did not practise artificial head-deformation. They were nomadic hunters. The survivors live on the Flathead Reservation with other members of their ancient federation, the Kootenai and Pend d'Oreilles, and members of other tribes of the area. They have long been in contact with whites, maintaining themselves now principally by stockraising and some agriculture.

SALISHAN, an important linguistic stock whose tribes formerly occupied practically all of the southern half of British Columbia, the southeastern section of Vancouver Island, portions of northern and western Washington, northern Idaho, western Montana and a small strip on the northwest coast of Oregon. The

SALMON



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

SALMON LEAPING THE FALLS

An unusual photograph of an Atlantic salmon ascending the falls of a river in Quebec.

name Salish was originally applied only to a large tribe in Montana popularly known as Flatheads. Juan de Fuca in 1592 was probably the first white man to visit the country of the Salish but nothing detailed was known of them until the Lewis and Clark expedition of 1804-6. Physically and culturally the stock may be divided into groups, the tribes of the coast and Puget Sound and those of the interior. The coast tribes were more advanced and form the southern arm of Northwest coast culture. Slavery and Portlatch were regular customs and head-flattening was more extensively practised than among interior tribes. Their houses were long rectangular structures of split cedar boards accommodating many families, each family having its own fire. Fish was their chief article of diet. The interior tribes depended largely upon hunting but also fished for salmon which were plentiful in the rivers flowing through their territory. Roots and berries were an important item. Their houses were conical structures, made of mats or bark covered with mud and built over a shallow pit. Descent among both coast and interior groups was reckoned through the father. In general, the primitive characteristics of the Salish were of a low order. They practised no agriculture, were constantly at war with each other and had practically no form of government. In 1931 they numbered approximately 18,000, probably $\frac{1}{3}$ of their original number.

The principal Salishan dialects may be grouped as follows: Interior, comprising the Lillooet, the Nlakyapamuk or Thompson Indians and the Shuswap in British Columbia, the Okinagan and its subdivisions in British Columbia and extending into the United States, the Flathead and its subdivisions in Washington, Montana and Idaho, the Cœur d'Alene in Idaho, and the Columbia groups in the western part of the interior of Washington; Coast, from north to south, the Bella Coola of Dean's inlet, the Comox group, the Cowichan group of Vancouver Island and the Fraser Valley, the Squawmish group of Washington, the Songish group of Washington and British Columbia, Nisquali group embracing all tribes east of Puget Sound and south to Mt. Tacoma, Twana group on Hood Canal, Chehalis group, Washington, and the Tillamook on the coast of Oregon.

SALLUST, (GAIUS SALLUSTIUS CRISPUS) (86-34 B.C.), Roman historian. After service under Caesar in the Civil War and after holding the governorship of Numidia, Sallust returned to Rome where he devoted himself to writing. His extant works are an account of the Catilinarian conspiracy, *De Coniuratione Catilinae*, and of Rome's war with Jugurtha, *Bellum Jugurthinum*. His most important work, a history of Rome from 78-67 B.C., *Historiae*, is almost entirely lost. A delightful stylist, his anti-aristocratic bias is clear. Sallust died in 34 B.C.

SALMAGUNDI, a mixed dish of chopped meat, pickled herring, oil, vinegar and spices. *Salmagundi* was the name of a short-lived periodical edited by WASHINGTON IRVING and J. K. Paulding, and the title of a satirical miscellany collected into a book called

also *The Whim-Whams and Opinions of Launcelot Langstaff and Others*, containing humorous sketches on the society and politics of the day.

SALMON, a large, soft-rayed fish (*Salmo salar*), allied to the Trout and the Pacific salmon, highly valued as a food and game fish. It occurs on both sides of the North Atlantic, ranging in the New World from Hudson Bay to Cape Cod, and enters rivers to spawn. The adult salmon is elongate in form with a small head, large mouth, and almost square tail. In color it is steel-blue above, and silvery on the sides, with numerous black markings. Salmon weighing over 80 lbs. have been recorded, but a weight of 40 lbs. is rare and 10 to 12 lbs. is the average.

The "parr" or young salmon, marked with dark transverse bars and numerous red spots and attaining a length of 7 or 8 in., usually remains in fresh water for two years after hatching. As it descends to the sea in shoals it assumes a silvery hue and is known as "smolt." After a winter in the ocean it is known as "grilse," and is distinguished from mature fish by its more slender and spotted body and more deeply forked tail. Upon reaching maturity the salmon again enters fresh water for the purpose of spawning, often leaping over small waterfalls in its migration. Unlike the Pacific salmon, it usually survives to return to the sea. The salmon has rich, finely flavored flesh, and is caught in great numbers for the market as it begins to ascend the rivers.

Pacific Salmon (*Oncorhynchus*). This group comprises the most valuable commercial fishes occurring in North American waters. From the Atlantic salmon they differ somewhat in form and strikingly in breeding habits. They abound in great numbers in the North Pacific Ocean, ascending the rivers of both North America and Asia to spawn. There are five species, the quinnat, the blueback, the humpback, the silver, and the keta. Of these the three first named are the most important. The quinnat and blueback usually begin their run up streams late in March, continuing until the spawning time in autumn; the others run only in the fall months. During the run none of the species feed, their stomachs shrivel and their flesh loses its pink color, becoming poor and dry. After spawning the fish soon die. The eggs, which are laid in the gravel beds of cold streams, sometimes more than 2,000 miles from the sea, hatch in four to six months. Upon attaining a weight of a few ounces the young descend to the ocean where they feed chiefly on various small marine animals. Upon reaching maturity in the course of three to five years they return to their native rivers to spawn. The most valuable commercial catches of salmon are made chiefly near the mouths of rivers in spring and early summer when their flesh is firm and highly colored.

The quinnat (*O. tshawytscha*), called also chinook and king salmon, the most highly prized species, has rich salmon-red flesh, and usually weighs about 20 lbs. It runs chiefly in the larger rivers, especially the Sacramento, Columbia and Fraser. The blueback (*O. nerka*), known also as a sockeye and red salmon, sec-

ond in quality only to the quinnat, usually weighing about 6 lbs., is the chief salmon of British Columbia and Alaska. The humpback (*O. gorbuscha*) or pink salmon, similar in size though inferior in quality to the blueback, is canned in great quantities in Alaska. The keta, chum or dog salmon (*O. keta*), weighing about 12 lbs., and the smaller coho or silver salmon (*O. kisutch*), the latter common in Puget Sound, are also extensively used for food.

In 1929 the commercial catch of Pacific salmon in United States waters amounted to 584,495,000 lbs., valued at \$20,449,000, of which Alaska contributed 442,602,000 lbs. with a value of \$10,842,000. The greater part of this catch was made into canned salmon valued at \$56,085,697; Alaska's share of this total amounted to \$40,469,385. The catch in British Columbia was 169,572,000 lbs. with a total value, marketed fresh and canned, of \$14,265,795. See SALMON FISHING.

A. B. J.

SALMONBERRY, a large handsome species of raspberry (*Rubus spectabilis*) found from California and Idaho to Alaska. It is sometimes cultivated for its showy rose-colored or purplish flowers and its attractive, usually salmon-colored, edible fruits.

SALMON FISHING, a form of angling which fresh-water fishermen class as the king of sports. One or more of the five salmon genera are found in almost all of the temperate and arctic zone waters of the northern hemisphere. Salmon are found in the rivers of Scandinavia and as far south as the northwest of Spain. They are known in the Rhine and are found in streams from Labrador to southern Maine. The landlocked salmon of the Maine and Canadian lakes are considered a different species by some authorities. The king salmon of the North American Pacific coast, commonly designated as *Oncorhynchus*, is seldom caught with hook and line.

Salmon rods run from 12 to 17 feet in length and are heavier than trout rods. Each fisherman has his own choice of line, reel and other tackle, and there is a bewildering variety available. Salmon flies are larger and gaudier than those used for trout, though here again, sizes and colors differ so much that there is no standard. In many localities, including some of the landlocked ponds of Eastern North America, salmon do not rise to flies as well as to spoons and other spinning devices. Here live bait of various kinds, such as grasshoppers, small minnows and worms are the most successful. In European waters, salmon are often caught by trolling with spoons or with live bait, and by bottom fishing, using shrimps, prawns and worms.

See Joseph Adams, *Salmon and Trout Angling*, 1923.

SALOME, the name of at least two women whose lives are interwoven with great events in the New Testament narratives. One was the daughter of Herodias, who was the wife of Herod Philip and who deserted him for Herod Antipas. The dancing of this Salome is said to have led Herod rashly to promise her anything that she asked. After consultation with her mother, she demanded "the head

of John the Baptist," whom Herod had imprisoned and now reluctantly beheaded. The second Salome was one of the women who witnessed the crucifixion of Jesus and afterward visited his sepulcher. She is usually regarded as the wife of Zebedee and the mother of the disciples James and John.

SALOME, an opera in one act by RICHARD STRAUSS, libretto by OSCAR WILDE, being a German translation by Hedwig Lachmann of Wilde's French play *Salome*; première, Dresden, 1905, New York, 1907. It is among the most famous of Strauss's operas. In the United States its pagan theme caused its removal from the repertory of the Metropolitan Opera, New York, after a dress rehearsal and one performance.

In the palace of Herod Antipas, tetrarch of Judea, a banquet has reached the stage of high revelry. On the terrace outside, Narraboth gazes amorously at the Princess Salome, step-daughter of Herod and the daughter of Herodias, the king's consort. A page warns Narraboth, captain of the guards, that the beautiful princess is unscrupulous. Meanwhile the voice of the prophet Jokanaan, otherwise John the Baptist, rises from the cistern where he is imprisoned. It denounces the sins of Herod's court and sends a shudder of fright through the soldiers. During their discussion of Jokanaan, Salome appears, a sinuous figure not unlike her mother, Herodias, who slew her husband in order to marry Herod. Jokanaan's voice fascinates her. She demands that the prophet be brought forth so she can gaze on him. Narraboth, appalled by her sacrilege, commits suicide, and Jokanaan returns to his cistern, immune to the blandishments of the princess. Herod, however, is more susceptible. His eyes have often played over Salome who now decides to turn the king's vengence to her own advantage. Consequently, she promises to dance for Herod, if he will grant a single request. His eyes aflame, he promises to grant any request, even though it be half his kingdom. So Salome performs a dance of the seven veils in which one veil after another is flung from her. To Herod's horror she then utters her wish, that the head of Jokanaan be brought to her on a silver platter. He tries without success to dissuade her. Herod orders the executioner to do Salome's bidding, and, with a hungry cry, Salome seizes the dead head of the prophet, pressing her fevered lips to those, which alive, had refused to kiss her. She fondles the head and gazes at it rapturously. Unable to witness Salome's behavior, even Herod himself is at last outraged and commands the soldiers to slay the princess.

SALONA, Serbo-Croatian Solin, a Dalmatian town in YUGOSLAVIA picturesquely situated at the foot of a mountain, still surrounded on all eminences with ruins of Roman buildings and early Christian basilicas and graves. In ancient times it was the largest city in Dalmatia and during the Roman rule the capital. After the Goths in 535 and the Avars in 615 destroyed it, many of the inhabitants moved into the empty Diocletian's palace in Spalato. Pop. 1921, 2,431.

SALONIKA, or **SALONIKI**, anciently Thessaloniki, capital of Macedonia and next to Piraeus the largest port of Greece, is located on the Chalcidic Peninsula in the Gulf of Salonika. From the flat shore of the bay the houses rise in terraces up the hill to the crest on which stands the "seven-tower" fort.

Salonika is the center of import trade for all Macedonia and with its splendid harbor the port of shipment for the products of a much larger area. The most important exports are grain, flour, cocoons, nuts, minerals and metals, skins, livestock, wool, poultry, opium and tobacco. Among its industries are cotton textiles, brewing, tanning, milling and the manufacture of tiles. It is the terminus of several important railroads, being directly connected by trunk lines with Athens, Constantinople, Belgrade and Monastir.

The city was built by Cassander in 315 B.C. and for centuries was the main station on Rome's road to the East. Throughout its history it has been the objective of military campaigns and has been occupied and governed by Romans, Byzantines, Sicilians, Venetians, Bulgarians and others. In 1430 it fell into the hands of the Turks, who had three times before captured it, and remained under their consecutive rule until 1912 when the Greeks occupied it and made it the seat of the governor of Greek Macedonia. Half the city burned to the ground in 1917 but since it has been rebuilt along modern lines it is now one of the busiest and most thriving cities in all southeastern Europe. Because of the emigration of the Turkish and Bulgarian inhabitants and the settlement of Greek refugees from Asia Minor in the 'twenties, the population showed considerable fluctuation. Pop. 1928, 236,524.

SALONIKA EXPEDITION, 1915-18, a series of thrusts chiefly by French, Serbian, and British troops, along the Balkan front, designed to aid the beaten Serbs and retard the growing power of Germany in the Balkans during the World War. After the Austrian victory of Oct., 1915, the remnants of the Serbian armies were hemmed in north of the Greek port of Salonika. Here the French and British reinforcements commanded by Gen. Sarrail, planned a northern march in November to relieve the Serbians; but the Bulgarians closed the only pass through which the Serbians could retreat. Sarrail, faced by winter and with news that the Serbians were planning a retreat by way of Albania to the west, fell back on Salonika. But by July 1916, Sarrail had received reinforcements which gave him a total of 300,000 men, as opposed to a reputed Austro-Bulgar-German force of 280,000 men. On Sept. 10 British troops crossed the Struma, due north of Salonika, the Serbs captured Gorniceyo, west of the Vardar, and on Nov. 19 they occupied Monastir, which they held as the extreme left of the front. In the face of the imminent Rumanian collapse Sarrail was ordered to stabilize his front and hold it defensively. Save for minor charges, the Salonika expeditionary forces were inactive until Sept. 1918, when French, British, Italian, Serbian, Rumanian and Greek troops, numbering

about 574,000, and commanded by Gen. Franchet d'Esperey, launched a major offensive. A heavy bombardment on Sept. 14 on the Sokol-Dobro-Polje front of seven miles, northwest of Voden, accompanied an infantry break-through. On Sept. 16 the French and Serbs penetrated the Bulgarian front for a distance of five miles, and by Sept. 21 the Bulgarian front had disappeared. Five days later the Bulgars asked for peace.

SALSIFY (*Tragopogon porrifolius*), a tall smooth biennial of the composite family, cultivated for its long edible tap root used as a vegetable. It is a native of the Mediterranean region, more extensively grown 200 years ago than at present, and very widely naturalized as a wayside weed. The erect stem, sometimes 4 ft. high, bears keeled tapering leaves and showy purple flowers in large, long-stalked heads. The fleshy root has a somewhat oyster-like flavor, on account of which it is often called oyster plant or vegetable oyster. Spanish salsify or scolymus, a biennial herb (*Scolymus hispanicus*) is larger, more productive and more delicately flavored than common salsify but is harder to handle because of its prickly leaves. See also SCORZONERA.

SALT, in chemistry, the term used to signify the solid product formed by the neutralization of an acid with a base. For example, common salt may be produced by neutralizing hydrochloric acid, HCl, with sodium hydroxide, NaOH. The product is NaCl, or common salt, and water, H₂O. Other salts are similarly produced by other reactions. A BASIC SALT is one which still contains some of the basic radical, OH, and an ACID SALT contains some hydrogen, H.

SALT, the common name for a crystalline substance, known chemically as sodium chloride, very widely and abundantly distributed in nature, both as rock salt or HALITE and in solution, as in the ocean, salt lakes, and brine deposits.

Common table salt is essential to life. It enters into the composition of the human body and forms a necessary constituent of the blood stream. Most of the secretions of the body, such as tears and sweat, are salty. A solution containing 8 grams of salt per thousand of water is non-injurious to the most sensitive of living tissues and, in severe cases of loss of blood, can be injected into the circulatory system where it will maintain life for a short time. This is known as the "Physiological Solution" or "Saline Solution." Salt also puts the secretions of the stomach into motion and provides the hydrochloric acid and other chlorine compounds necessary for digestion.

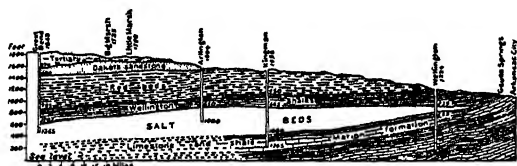
As an article of human diet, however, salt did not come into general use until the time of the transition from the pastoral, nomadic stage to that of agriculture. This is because meat eaters are not ordinarily salt eaters, it being the vegetarians who require the most salt. Wild animals fulfill their need for the substance at "salt licks," where they find natural concentrations in the form of salt lakes, springs, or efflorescences at the surface of the ground.

Sodium chloride, a compound of the gas chlorine

with the metal sodium, crystallizes in the isometric system, frequently forming cubes with re-entrant faces. From their shape, these are sometimes called "hopper" crystals. Clear crystals have an ice-like or glassy appearance. When pure, salt is colorless or white, but gray, brown, red and blue tints are not uncommon. It is soft, readily soluble in water, and its taste is distinctive.

Sodium and chlorine enter into the composition of many rocks. WEATHERING and EROSION liberate them, whence they go into solution in the drainage system of the region. Thus, the Mississippi River contains 0.002% salt at Memphis. Where running water is continually bringing more salt into a basin which has no outlet, evaporation produces a progressive concentration of the salt contents. The Atlantic Ocean contains 2.79% salt; Great Salt Lake, Utah, about 12%, and the Dead Sea about 7%. Where this process goes on the salt will eventually be precipitated. Beds from a few inches to several hundred feet thick may be deposited, often in a succession alternating with gypsum, anhydrite, limestone, dolomite, clay, and other mineral matter. (See DEPOSITS; SEDIMENTATION.) Extensive beds of this kind are believed to have formed in lagoons partially cut off from the sea by bars. In south-central United States the salt beds of Permian age are estimated to underlie an area of about 100,000 sq. mi., and deposits of this type are to be found in many parts of the world.

Such beds of "rock salt," as it is called, are frequently mined by a room-and-pillar system similar to that used in mining coal. The broken salt is hoisted to the surface, crushed, sized and prepared



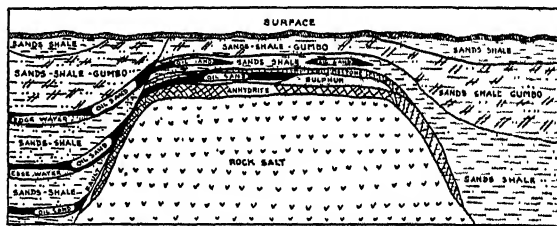
GEOLOGICAL CROSS SECTION IN KANSAS, SHOWING OCCURRENCE OF BED OF SALT

for the market. Frequently the deposits are exploited by drilling a hole down to the bed and forcing water down through a pipe. Salt goes into solution, and the brine is pumped to the surface. There it is evaporated in pans heated with steam coils (Grainer Process), or under a partial vacuum (Vacuum Pan Process), the precipitated salt being ready for marketing. At the Great Salt Lake, lake water is evaporated in the sun to produce salt, a process used in small operations at the sea-side in many favorable climates. Natural brines are pumped to the surface and utilized at some places, as in Michigan and Ohio.

The United States is the world's largest salt producer, with the United Kingdom and Germany close rivals for second place. In 1930, the United States produced 8,000,000 short tons of salt, most of which came from Michigan, New York, Ohio, Kansas,

Louisiana, and California. Most of the salt evaporated from brines comes from Michigan, while the states important for rock salt mining are Kansas, New York, Louisiana, and Michigan, in the order named. Chlorine and caustic soda are made from the brines of Michigan, Ohio, New York and Virginia.

"Salt domes" provide the source of Louisiana salt. They are great plugs of salt, gypsum, anhydrite, sulphur, and limestone, sometimes several miles in diam-



TYPICAL SALT DOME SECTION

eter, probably derived from deep-seated beds and forced up through weak spots in the overlying rocks by pressure. Important petroleum deposits are often found in and near them.

The retreat of the Caspian Sea, through evaporation, has left salt lakes and "playas" over vast areas, in Asiatic Russia, Stavropol, and Astrakhan. From these, salt precipitates in the dry season. It is broken up, washed in the brine, shoveled out, piled and dried. After ageing two years it is marketed. Hills of salt are found in such dry regions as Spain, Persia, and Algeria.

Aside from domestic and fishery use, salt is utilized to produce salt cake, soda ash, caustic soda, sodium bicarbonate, sodium acetate, sodium chlorate, sodium phosphate, glauber's salts, calcium chloride, chlorine, and hydrochloric acid. S. F. K.

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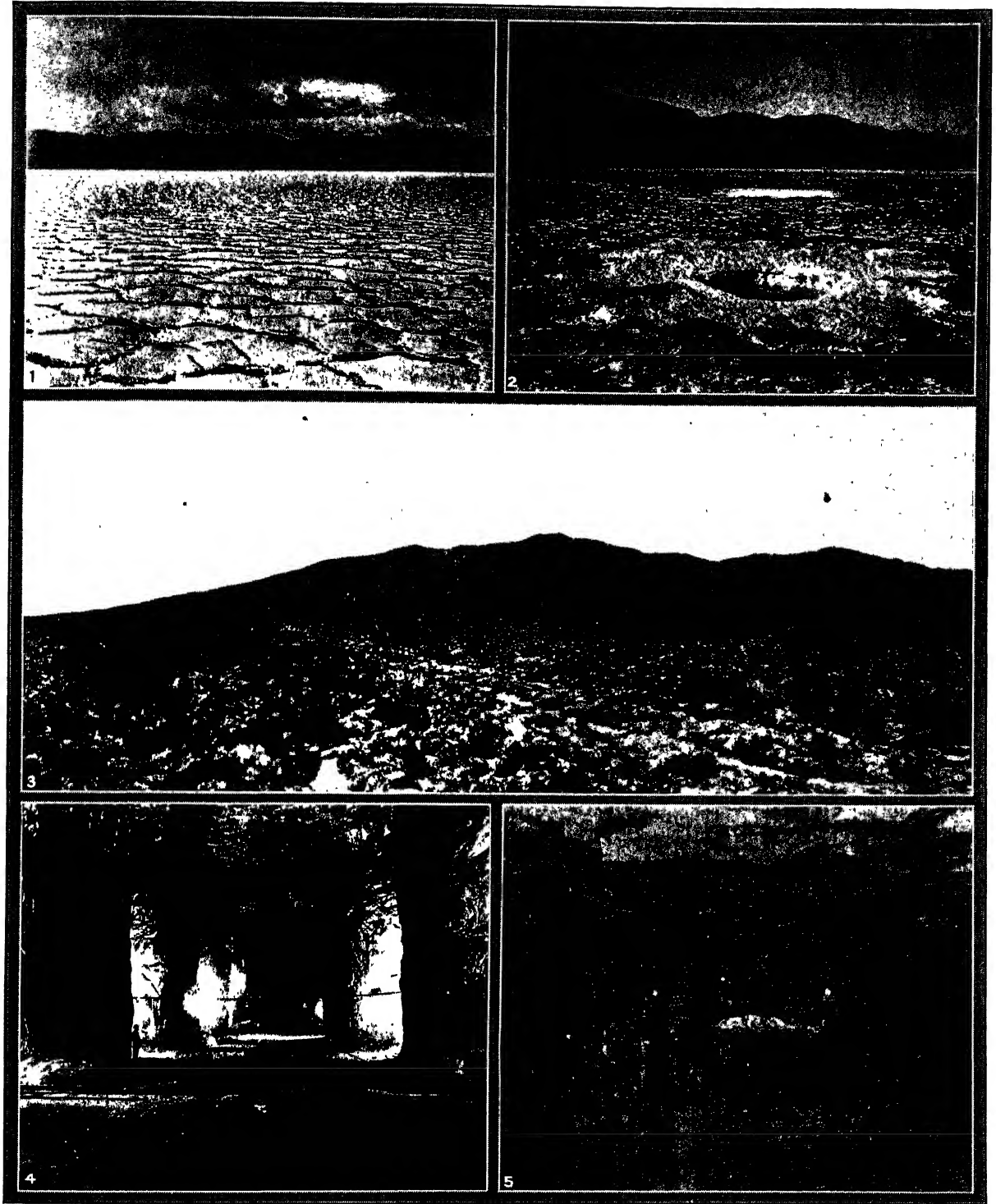
SALTA, a province of northwestern Argentina. It encloses an area of 48,302 sq. mi. and has a population (estimated, 1931) of 177,924. The capital of the province is Salta.

SALTA, a city of Argentina, situated in the northwest part of the republic. It lies on a plain about 3,500 ft. in altitude and has a variable climate. In the vicinity the first battle for independence from Spain was won by General Belgrano. The soil of the surrounding country is rich, producing cereals, tobacco, coffee, alfalfa and tropical fruits. The city was founded about 1581. Est. pop. 1930, 34,374.

SALTBUSH, a name given in Australia to certain native species of *ORACH* (*Atriplex*) cultivated for forage, especially to *A. Nummularia*, *A. halimoides* and *A. semibaccata*, native to arid saline soils. The last-named species is grown as a forage plant and somewhat naturalized in California where it is called Australian saltbush. See ATRIPLEX.

SALT GRASS, a name applied to various grasses growing in saline soils along seacoasts or in alkaline desert regions, especially to the **ALKALI GRASS** or

SALT

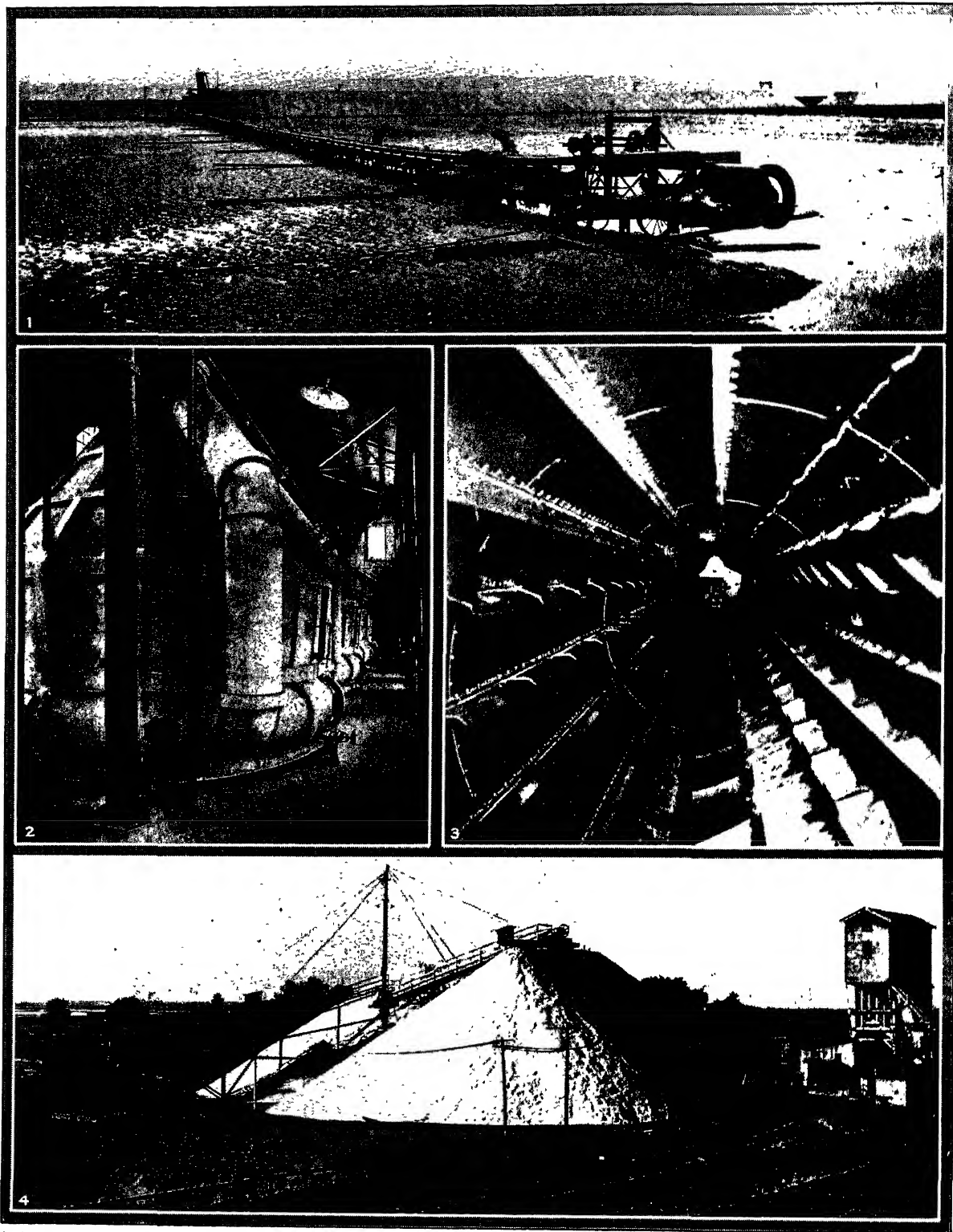


TYPICAL SALT FORMATIONS

1. Salt crust in the floor of Saline Valley, California. 2. Brine well in the salt formation on the bottom of Death Valley, California. 3. View of the salt field in the bottom of Death Valley at the crossing of the old Borax Road from Greenland Ranch to Bennett Wells. 4. Salt mine in

Louisiana, showing tracks on which cars loaded with salt move to the shaft, and pillars of salt left to support the weight of overlying rocks. 5. Underground in a salt mine in Kansas. Miners are loading a mine car with lumps of salt dug from the "working face."

SALT



1, 4, COURTESY LESLIE SALT CO.; 2, 3, WORCESTER SALT CO.

PROCESSES IN THE PRODUCTION OF SALT

1. Harvesting salt by means of a conveying belt, at the end of which the salt is washed and piled. 2. Vacuum pans used to evaporate the brine. 3. Revolving dryer, 30 ft. long and 6 ft. in diameter. 4. A 90,000-ton stack of crude salt.

spike grass (*Distichlis spicata*) of wide distribution in North and South America and in Australia. In the United States several species of cord grass (*Spartina*) are commonly called salt grass, as the salt marsh-grass (*S. stricta*), the salt reed-grass (*S. cynosuroides*) and the salt-meadow grass (*S. patens*), the last named furnishing much of the marsh hay of the Atlantic coast.

SALTILLO, a city of Mexico, capital of the state of Coahuila, is situated in the mesa, *Ojo de Agna*, about 74 mi. southeast of Monterrey. It has an altitude of 5,337 ft. above sea level, and is surrounded by rugged mountains. It is a progressive manufacturing city with paved streets and an abundant water supply brought from springs in the mountains. Saltillo has factories of cotton and woolen goods and flour mills, and is famed for its gay hand-woven blankets or *Zarapes*. It has an extensive park shaded by cottonwood trees, with flower-bordered drives and walks. This city is a center of education and culture and has some of the best schools in Mexico. A well-known private school for girls, a preparatory school for boys, the state normal school, good public schools and the old Madero Institute are situated here. The battle of Buena Vista, of the American war with Mexico, was fought just outside the city. A broken wall marks the place where old Fort Taylor stood on a hill in the town.

Saltillo was founded in 1586, was the capital of Texas and Coahuila in 1824, and is the birthplace of Manuel de Acuna, a Mexican poet of note. Pop. 1921, 40,451; 1930, 64,396.

SALTING, in mining, the artificial enrichment of ore samples to deceive an examining engineer. It has been used chiefly in gold mining, as a very small addition of the precious metal greatly changes the sample's content. Tricks used include: dusting the exposures with gold dust before **SAMPLING**, spitting gold-bearing tobacco juice into the sample while it is being taken, and injecting gold solutions through syringes into the closed bag of the complete sample. *See also* **MINE EXAMINATION**.

SALT LAKE CITY, city and capital of Utah, in the northern part of the state. It is situated 15 mi. southeast of Great Salt Lake and is served by four railroads, bus and truck lines, trolley lines, airways and Federal highways. The snow-capped Wasatch Mountains are at the edge of the city. The city is the headquarters of the Mormon Church, officially known as the Church of Jesus Christ of Latter-Day Saints, who came here under the leadership of Brigham Young in 1847. Features of interest are the marble and granite State Capitol, built in 1916, and the Mormon Temple, 1853-1893, with heavy granite walls and a famous organ, where none save Mormons may enter. Salt Lake City is the seat of the University of Utah.

The important industries are beet-sugar manufacture, mining and smelting, oil refining and food packing, and the manufacture of confectionery. In 1929 the factory output was worth about \$43,000,000; the

wholesale trade proper amounted to \$71,510,573, and the retail trade, to \$92,979,503. There are salt beds and farm land producing principally alfalfa, grain, sugar beets and vegetables in the vicinity. A unique feature of the city is Saltair, 16 mi. west, with a fine pier and beach for bathing in the lake. The city was chartered in 1851. Pop. 1920, 118,110; 1930, 140,267.

SALT LAKES. In arid regions, the waters of lakes without an outlet are dense with salt and other minerals, because the water left by evaporation leaves behind soluble salts brought in by rains and rivers. Some occupy but a portion of a large basin filled in a time of greater humidity of climate.

Old shorelines of Great Salt Lake, in Utah, plainly show that before desert conditions developed, it was an immense freshwater sea with an outlet through Red Rock Pass. With rapid evaporation and scanty rainfall, it gradually shrank below the outlet and its concentrated waters, now only 15 ft. deep, became so dense with mineral matter that a swimmer can submerge only with difficulty. Pyramid Lake, in Nevada, and the Dead Sea, in Palestine, are salt lakes of this type, as is Lake Van, in eastern Turkey, the saltiest lake in the world, which has a salinity of 33%.

The isolation of an arm of the ocean, sometimes produces a salt lake, as in the Caspian, once connected with the Black Sea. The Salton Sea, in California, cut off by the delta of the Colorado River, completely dried up, leaving a salt-encrusted basin. Accidentally flooded, during irrigation operations, it is now drying again. The Caspian Sea remains slightly saline, despite the inflow of fresh river-water, because evaporation exceeds intake.

The burdened waters of very salt lakes deposit glistening beds of gypsum and common salt, or of carbonate of lime in the form of rounded oolitic grains, or of calcareous tufa. At Great Salt Lake, which has a salinity of 18%, an extensive salt industry has developed. The waters are led into shallow basins where it evaporates, leaving clean, dry salt.

SALTO, a city of northern Uruguay, and capital of the department of Salto, situated on the Uruguay River 221 mi. by boat north of Buenos Aires, Argentina. It has good transportation facilities both by land and water, and is a thriving town. Its industries are meat packing and trading in wheat and wine. Est. pop. 1930, 35,000.

SALTON SEA, a brackish body of water in the Colorado Desert in southeastern California just north of the IMPERIAL VALLEY region. It has an area of about 287 sq. mi. and its surface is approximately 245 ft. below sea level. In past geologic ages the Colorado River flowed alternately into the Gulf of Lower California and into the depression of the present Salton Sea, being separated by the delta which is now Imperial Valley. Ancient beach lines indicate that at one time the surface of this sink was 40 ft. above sea level and had an area of some 2,100 sq. mi. This periodic inflow of the river probably ceased from 500

to 1,000 years ago. Until 1904 the area was known as the Salton Sink and consisted of a salt marsh 30 mi. long and 12 mi. wide, 280 ft. below sea level. In 1905-06 the waters of the Colorado were again diverted into Salton Sink due to inadequate gates controlling water for irrigation in Imperial Valley. The surface reached a level of -194 ft., and covered 516.2 sq. mi. to a maximum depth of 79 ft. The Colorado was finally forced back into its course to the gulf in 1907. By 1920 the Sea had receded to 248 ft. below sea level and has since remained at approximately this level due to natural drainage and seepage of the surrounding region.

SALTPETER, a common name applied to potassium nitrate (KNO_3). It is found in limited quantities in natural form in Spain, Egypt, Persia and the East Indies, but is usually prepared by adding potassium carbonate to sodium nitrate (NaNO_3) commonly known as Chile saltpeter. Ordinary saltpeter is used in the manufacture of explosives, as an ingredient of fertilizers and as a food preservative.

Sodium nitrate, NaNO_3 , is known commonly as Chile saltpeter. It occurs in large deposits in South America, particularly in Chile. Calcium nitrate, $\text{Ca}(\text{NO}_3)_2$ is known as wall saltpeter; it may be found in natural form on the walls of stables. Its principal use is in fertilizers and in the manufacture of nitric acid. It is manufactured from atmospheric nitrogen.

SALT RIVER, in American political jargon, the limbo of defeated political parties or candidates. The term is said to have originated in Kentucky where there was a river up which many travelers were mysteriously lost.

SALT SPRINGS DAM, located on the Mokelumne River, Cal., is the highest rock fill dam in the world. The structure is 300 feet high above streambed and 328 feet above lowest foundation level, contains 3,000,000 cubic yards of loose rockfill and has a crest length of 1300 feet. The top width is 15 feet and the maximum thickness at the base, 900 feet. The upstream face is a 15-foot thick layer of large derrick-placed rocks on which rests a waterproof facing of reinforced concrete varying in thickness from 3 feet at the bottom to one foot at the top. It stores about six billion cubic feet of water to supplement the natural stream flow used to produce hydro-electric power at a number of sites. The spillway is a separate structure adjoining one end of the dam.

SALUDA DAM, located on Saluda River near Columbia, S.C., is an earth dam 208 feet high above the bed of the river and is notable for its length of 7,838 feet and its contents of 11,000,000 cubic yards. It is 25 feet wide on top and 1150 feet thick at the base. It creates a storage reservoir of 100 billion cubic feet for the generation of hydro-electric power. The spillway is a separate structure near one end of the dam.

SALUTE, NATIONAL. In the United States the national salute consists of 21 guns. The interval between guns in all salutes is 5 seconds. Salutes are

not fired between sunset and sunrise nor on Sunday, unless required by international courtesy. The national ensign (*see* FLAGS) must always be displayed during a salute.

SALVADOR, a republic of Central America, lying along the Pacific Ocean and bordered on the northeast by Honduras and by Guatemala on the northwest. Area 13,173 sq. mi. Pop. 1930, 1,459,578. Capital, SAN SALVADOR; pop. 96,447.

The coast line is 160 mi. long with an average breadth of 60 mi. Beyond the narrow, low alluvial plain along the sea is an interior plateau, about 2,000 ft. above sea level, containing a row of volcanoes. Six of these volcanic cones reach the considerable height of 4,000 to 7,000 ft. and virtually all have been active in historic times. To the very edge of the lava wastes, which run out like spurs from the mountains, the fields are green and where the lava rocks appear less frequently fine trees have pushed their way up through their crust. An earthquake in 1919 did great damage to the capital. Among the numerous rivers of Salvador the most important are the LEMPA, the Paz and the San Miguel; the Lempa flows through the entire territory of the republic, but all are navigable only for small craft. Lakes Guijar and Ilopango are picturesque. Ilopango presents the outlines of a circular crater 25 sq. mi. in extent and enclosed by steep rocky walls. It is subject to frequent oscillations of level, sending its overflow through a deep gorge to the Jiboa, a small stream, and sometimes rapidly subsiding within the encircling cliffs. In 1879, Ilopango discharged vapors and lavas as from a real crater, while several volcanic islets appeared above the surface and after a little while again subsided.

The balsam tree is one of the most beautiful of the tropical forest. Balsam is collected by balsameros, natives who live in the woods and who from early youth have cultivated the skill necessary to incise the tree for the extraction of the juice. Indigo, for which Salvador was at one time famous, is now little grown, the industry having been almost ruined by the competition of the cheap aniline dyes of modern chemistry. The prosperity of the republic depends on its coffee crop, which is grown on about 150,000 acres, is of the finest quality and commands a high price in world markets. Rapid advances have been made in recent years in the growing of sugar cane, and as transportation facilities improve greater quantities will be exported, as the climate and soil seem to be admirably adapted to the cultivation of this plant. Sugar exported in 1929 amounted to 6,218 tons; 9,769 in 1928; and 7,744 in 1927. About 100,000,000 lbs. of coffee are produced annually. The country is rich in minerals, such as gold, silver, copper, lead, iron and mercury, which, however, have been very little developed.

The coast and central districts are the least salubrious parts of the country, and the population is concentrated chiefly on the dangerous igneous plateau. The temperature on the hot, low-lying seaboard

ranges between 75° and 85° F., falls on the outer volcanic ramparts to 72° or 74°, and rises to 85° or 90° in the deep valley of the Lempa, sheltered both from the Atlantic and Pacific breezes. The heavy rains, brought by the *Vendavales*, or southern marine winds, prevail chiefly between May and September, and are occasionally accompanied by destructive cyclones.

Except a few semi-independent groups about the Honduras frontiers, and the Pipils, who are of the same Aztec stock as those of Guatemala, all the aborigines are now merged with the early Spanish settlers in a common Ladino population of Spanish speech and culture. Pure Europeans of various nationalities number about 25,000; there is also a distinct Negro strain, due to the black slaves imported before the emancipation.

The republic's present constitution dates only from 1864, and has been modified several times. The president is assisted by four ministers of state appointed by himself. His election for a term of four years is by popular vote.

HISTORY

Dispatched by HERNANDO CORTÉS from Mexico, PEDRO DE ALVARADO led an overland expedition which invaded the region of the present Salvador in 1524, and in 1525 captured the Indian capital, Cuscatlan. The city of San Salvador was founded in 1528, and transferred to its present site in 1539. The region was governed as a part of the vice-royalty of Guatemala. Its colonial history is broadly that of Central America in general. In 1821, however, republican sentiment was more articulate in Salvador than in the neighboring provinces; and in an endeavor to forestall the absorption of the region into Iturbide's Mexican empire, a convention at San Salvador in Dec. 1822 voted for incorporation with the United States of America. Salvador was a member of the United Provinces of Central America from its inception in 1823 to its dissolution in 1838, except for one brief period of secession. Throughout the confederation's history Salvador represented liberalizing tendencies, in opposition to the conservative, pro-clerical influence of the dominant state of Guatemala. The politics of Salvador have retained distinctive characteristics, perhaps because of the geographic unity of the country and the greater fusion of the white and Indian races.

On Jan. 30, 1841, the territory was officially designated the Republica del Salvador, and shortly afterward Constitutional Government, with a president and bicameral legislature, was established. Factional opposition between Liberals and Conservatives embittered politics, and provoked occasional revolutions, during the first 60 years of republican independence. For cooperation in the field of foreign relations, Salvador entered a loose confederation with Honduras and Nicaragua in 1849. Possibilities of the development of a new Central American union from this nucleus were dissipated by war in 1863 between Sal-

vador and Guatemala. Salvador was a party to the attempted federation of Central America in 1895-98, and furnished the initiative for the short-lived Central American Union of 1921. Since 1896 its domestic politics have been conspicuously orderly.

For bibliography see COSTA RICA, *History*.

SALVAGING, the recovery of vessels abandoned at sea, or the raising of vessels and their cargo which have sunk close to shore. In the latter case a variety of methods are attempted, as by lifting the vessel by putting ropes under her which are fastened to pontoons, or by closing all the hatches in the ship and then using compressed air to expel water from the damaged compartments.

SALVARSAN. See ARSPHENAMINE.

SALVATION ARMY, THE, was founded first as The Christian Mission by WILLIAM BOOTH, an English Methodist evangelist, and his wife, Catherine Booth, about 1865, for the revival of religion among the masses. The organization adopted a quasi-military pattern in 1878, denominating its officers, generals, majors, captains, etc.; permitted both sexes to hold office, and by means of street religious meetings and processions extended its membership to all English-speaking countries and to many foreign lands. The organization came to the United States in 1880, and has since become active in every large community in the country. Its membership is largest in the industrial states, in the following order: New York, Pennsylvania, Massachusetts, Illinois, Michigan, Ohio, Washington, Minnesota and California. Although services are chiefly conducted in English, they are also held in Swedish, German, Spanish, Italian and even Chinese. The Salvation Army has no formal creed; it follows the beliefs of most evangelical Protestant churches, but places emphasis more on Arminian than Calvinistic doctrine. Everyone who joins the organization must sign the Articles of War, which call for total abstinence from intoxicating liquors and harmful drugs, and in general pledge the member to humane ideals. The two leading branches of work are the field and the social services, the former dealing with the strictly religious activities, the latter with its rescue homes, night shelters, homes for the unemployed and stranded and other humane activities. In support of the latter service, the Salvation Army has won the cooperation and admiration of members of nearly all religious bodies. The ideal of the founder provided a policy that was patriarchal, namely, that the officer of higher rank should regard those beneath him as a father regards his children, and protect and guide their lives. An effort was made to keep this ideal behind the military autocracy which chiefly characterized the Army's rule; but in recent years, democratic choice has become more influential in such matters. The international headquarters are in London; but each country has its own organization under the direction of a commander, who is assisted by responsible officers. EVANGELINE BOOTH, daughter of William Booth, was made commander in the United States in 1904.

SALVATORIANs, or Society of the Divine Savior, a congregation founded in Rome in 1881 by Father John Baptist Jordan. A special vow for the mission apostolate is taken to further the Society's aim of "religious enlightenment." To this end the Salvatorians labor in parishes and in the mission field, at present the province of Fu Kien, China. They are also active in educational and social work, and extensively publish Catholic literature in German. At Rome they have charge of the Blessed Sacrament Chapel in St. Peter's. A total of 32 houses of the Society are established in the United States, South America, England and most European countries, with the mother-house in Rome. A membership of about 500 includes 200 priests. An affiliated sisterhood has 65 houses and 1,000 religious.

SALVE BUG, the common name for a species (*Aega psora*) of pill bug (*Isopod*), which is parasitic on fish. It has a beetle-like, elliptical body, about 3/5 of an inch long. Salve bugs are found commonly on rays, flat fishes and cod taken in the Gulf of Mexico, off the northeast coast of America, and off the coast of Europe. Fishermen use them for a salve.

SALVIA, an immense genus of herbs and shrubs of the mint family, including many ornamental, culinary and medicinal plants. There are about 550 species, widely distributed in temperate and warm regions; some 40 occur in North America, mostly in the southern and western United States. They vary greatly in habit, ranging from small annual herbs to shrubs several feet high, bearing entire, toothed or divided leaves and showy, variously colored flowers, usually in dense whorls. Upward of 50 species are more or less cultivated. Three salvias are grown for their leaves, used in seasoning and in medicine; these include the garden sage (*S. officinalis*), the clary (*S. sclarea*) and the annual sage (*S. Horminum*). The ornamental salvias form two important groups, those with scarlet flowers and those with blue, purple, violet, white or variegated flowers. Of these the scarlet sage (*S. splendens*), a late autumn bloomer with large masses of brilliant scarlet flowers, is the most popular. See also CHIA.

SALVO, originally a general discharge of guns intended as a salute. It now means the successive fire of guns, individually and at regular intervals of about two seconds, starting from either flank of a battery. This is at present the habitual method of RANGING, as the shells bursting one after another in regular order enable an observer to determine whether each of the guns is firing correctly. See also FIRE CONTROL.

SALZBURG, capital of the former Archbishopric of Salzburg, a powerful ecclesiastical principality in Austria. It was secularized at the beginning of the 19th century and became part of Austria in 1816. The city is imposingly situated on the banks of the Salz-bach and, though it dates back to Roman times and has Christian catacombs of the third century, it presents the aspect of the 17th century, due to frequent devastating fires and the passion for building on the

part of the prince archbishops. The outstanding buildings are in the late Renaissance, Romanesque, Gothic and early Baroque style, including the Imperial Palace, the cathedral, various abbeys and parish churches. The house in which MOZART was born contains many remembrances of the great composer. The fortress overlooking the city was built in 1077 by Archbishop Gebhard and is now a barracks. Salzburg is a popular summer resort. Industrially, it has factories which produce various small products, such as iron ware, artificial wool and cement. Some musical instruments and stone ornaments are also made there. Pop. 1923, 37,856.

SAMAIN, ALBERT VICTOR (1858-1900), French poet, was born at Lille, Apr. 3, 1858. He led the simplest of provincial lives, as a bank clerk and municipal employee. The publication of *Au jardin de l'Infante*, 1893, brought him fame, together with sufficient means for modest travel and a freer life. His work is reminiscent of CHARLES BAUDELAIRE, though Samain is simpler, gentler and more tender, as is well shown in his *Le Chariot d'or*, 1901. Samain died of tuberculosis, at Magny-les-Hameaux, Aug. 18, 1900.

SAMANIDS, DYNASTY OF, an East Persian dynasty founded in the 9th century. Although acknowledging the overlordship of the caliphs of Bagdad, the Samanids were practically independent rulers of Transoxiana and most of PERSIA. When the head of family was converted from Zoroastrianism to Islam early in the ninth century, his sons received provinces from the caliph. By subjecting the SAFFARIDS, they made sure their sovereignty in Persia. The first ruler, Saman, and his successors sponsored the extraordinary development of Persian poetry. The last of the Samanids was Montasir, a renowned warrior and poet, who was assassinated in 1005. The Samanid dynasty was succeeded by the Ghaznevids, who founded the Mussulman empire of India.

SAMARA, in botany, a dry, indehiscent, one-seeded fruit, ripened from a single ovary or from part of a compound ovary, and provided with a flat wing. Typical examples are the samaras of elm, one from each ovary, the wing surrounding the seed; maple, one from each half of the ovary, wing terminal, unsymmetrical; and ash, one from each ovary, wing terminal, symmetrical.

SAMARA, administrative center and principal commercial city of the Middle Volga Region of the R.S.F.S.R., in eastern European Russia, lying on an elevation between the Volga and Samara rivers. Because of its situation on railways and navigable waterways, it has developed into one of the foremost cattle, grain and dairy centers of the country. Samara has flour mills, one of the greatest grain elevators in the Soviet Union, a large macaroni factory and many small plants. The fort erected by the Russians at Samara in 1586 on the gateway to the East soon became the region's central trading point. Invasions and civil strife menaced its existence from time to time, and famine and disease followed the warfare of 1917. Pop. 1930, 197,718.

SAMARANG. See SEMARANG.

SAMARITAN, a SEMITIC language of the West ARAMAIC group preserved in an old translation of the Pentateuch and in medieval liturgical works. It extends the Palestinian Aramaic tendency to soften, mispronounce and even omit the gutturals. The Pentateuch translation is strongly influenced by Hebrew, and the later writings are affected by Arabic, the language spoken by the few Samaritan families who still live in Samaria (Nablus).

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SAMARITANS, the oldest Jewish sect still surviving in their ancient center, Nablus, the Biblical Shechem. They take their name from the land of Samaria, the section of Palestine once occupied by the tribes of Ephraim and Manasseh, which constituted the main portion of the Northern Kingdom of Israel. This kingdom was destroyed by Assyria in 721 B.C., as we learn from II Kings 17 and parallel Assyrian annals, and the upper classes were carried into captivity. Large numbers of foreign settlers were brought into the land; but it appears that many of the inhabitants still preserved their ancestral religion and their contacts with Judah and Jerusalem. The later tradition that they were semi-pagan has nothing to support it, for the sect as we know it possessed all the essentials of Judaism.

One fact enables us to obtain some dating. The Samaritans possess the Hebrew Pentateuch, but reject the later books of the Old Testament. As the Pentateuch appears to have become the definite Law of the Jews about 400 B.C. (Nehemiah 8-9), the Samaritans must still have been in fellowship with them, and the separation would have come later before the Jews added the subsequent books of the Bible. There is good reason to believe that Sanballat, who appears in the biography of Nehemiah, was concerned in the schism on its political side, and we know from Josephus that with the appearance of Alexander in Palestine, 332 B.C., the Samaritans were active rivals of the Jews, regarding their temple on Mount Gerizim, overhanging Shechem, as their holy place in the same way as the Jews regarded Jerusalem. They appear to have been a fairly numerous body, but never achieved independence as did the Jews under the Maccabees; we know of their settlements elsewhere, as in Egypt; and there are remains of their literature in the Greek language, translation of their Bible and other fragments. Down to the end of the Jewish state in 70 A.D. they appear to have been in constant friction with the Jews, although the latter did not completely disown them. The Jewish ruler John Hyrcanus in 128 B.C. captured Shechem and destroyed the Samaritan temple. There are several well-known references to the sect in the New Testament. The Jewish attitude appears in the reproach leveled at Jesus that "he was a Samaritan and had a devil." (John 8:48.) In the story of Jesus's healing of 10 lepers (Luke 17:11 ff.) he bids them all go and

show themselves to the priests, i.e. at Jerusalem, indicating, as indeed much other evidence shows, that the sect was not excommunicated. In the parable of the Good Samaritan (Luke 10:25 ff.) Jesus praises the virtue of an ideal Samaritan; and John 4 tells of his conversation with the Samaritan woman, when he tells her that the Samaritans know not whom they worship.

With the destruction of Jerusalem by the Romans came the definite split with the Jews. However, the Talmud contains many references to the sect, some of them not unfavorable. In points of theology they resembled the conservative Sadducees. Unlike the Jews the sect has continued in its ancient home; they suffered persecution under the Christian empire and had the ill-treatment of the Arab conquerors. Today they number about 150 souls, but with a small number of women, so that the race faces extinction; they exist in great poverty. Their principal literary treasure is their Law, written in Hebrew, the so-called Samaritan Pentateuch, the text of which varies in many places from the Jewish text, and which is of great importance for Biblical scholarship. They boast the possession of a very ancient copy of the Law, but there is nothing to prove this. There are also remains of a considerable literature, written in Hebrew, Aramaic and Arabic. The Samaritans alone perpetuate yearly the ancient Jewish sacrifice of the Passover on the site of their ancient temple; they retain their hereditary priesthood and follow the Levitical legislation of the Law, often with an interpretation different from that of the Jews. J. A. M.

BIBLIOGRAPHY.—J. H. Montgomery, *The Samaritans*, 1907; J. E. H. Thompson, *The Samaritans*, 1919; M. Gaster, *The Samaritans*, 1925.

SAMARIUM, a metallic chemical element belonging to the RARE EARTHS, the chemical symbol of which is Sm, atomic weight 150.4. Its salts give yellow solutions with a strong absorption spectrum. It was discovered by Lecoq de Boisbaudran in 1879, and occurs in many minerals such as monazite.

SAMARKAND, until recently the capital of the Uzbek S.S.R. (see UZBEKISTAN), in Soviet Asia, in the fertile Zeravshan River valley. It is an export and railroad center carrying on an immense traffic in dried fruits, grapes, rice, hides, wine, cotton, silk and cutlery. Although there is a silk mill in Samarkand, the natives are interested principally in making metal goods and pottery. As the old Marakanda, Samarkand was conquered by Alexander the Great, and later fell into the hands of the Arabs, of Jenghiz Khan and of Tamerlane, who adorned it with mosques, castles and gardens. Russian ownership dates from 1868. In the ancient fortress are many historic buildings, examples of elaborate Islamic architecture. Notable are Bibi-Khanum, a cathedral mosque, and the Sheik-Zinda mosque mausoleum, one of central Asia's most remarkable memorials. Samarkand has a new European section with hospitals, schools and day nurseries. In the ancient quarters brightly-hued mosques rise above low yellow buildings. The population is composed

of Tadzhiks, Uzbeks, Persians, Iranians and Russians. Pop. 1926, 105,106.

SAMARSKITE, a velvet black mineral, nearly opaque, glassy to resinous in appearance. It is sometimes found in veins in granite, with columbite, feldspar, and mica. Crystallizing in the ORTHORHOMBIC SYSTEM, samarskite is a complicated niobo-tantalate of uranium, iron, calcium, and the cerium and yttrium group of metals. One of the two remaining unknown elements, No. 87, was discovered in samarskite by Prof. Jacob Papish of Cornell University, according to announcement in 1931. See also COLUMBITE; CARNOTITE; PITCHBLEND; URANINITE.

SAMBAR, a species of deer (*Cervus unicolor*), frequenting hilly countries from Kashmir to China. The bucks stand 5 ft. high at the shoulder, and carry fine antlers, the beams of which are forked at the end. These brown, unspotted deer, each old buck leading several does, are hunted in the Himalayan foothills.

SAMBATYON, the name of a mythical river beyond which the Ten Tribes are supposed to have retired and thus been lost. It is part of the legend that the river flows during the six days of the week and disappears on the Sabbath. Eldad Hadani (the Danite) a Hebrew traveler of the ninth century in his "travels" offers the following description of the river Sambatyon: "It rolls sand and stones during the six working days and rests on the Sabbath. From the first moment of Sabbath to the last, fire surrounds the river and during that time no human being can approach within half a mile of either side of it."

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SAMISH, one of the groups of the North American Indian Songish division of the Salishan linguistic stock. They lived formerly on Sanish River and Bay, Wash., but the survivors of the group are now on the Lummi Reservation in Washington.

SAMOAN ISLANDS, a group of nine islands and five islets in the western Pacific, formerly known as Navigator's Islands. They lie between the parallels of $13\frac{1}{2}^{\circ}$ and $14\frac{1}{2}^{\circ}$ S. lat. and 168° and 173° W. long., about 4,200 mi. southwest of San Francisco. The total area of the islands is about 1,200 sq. mi. Except for Rose Island, they are of volcanic origin, and are encircled by coral reefs. The Samoans belong to the brown Polynesian race, and are well-formed and prepossessing, but are decreasing in numbers. Internecine struggles between rival chiefs for supreme authority led to the intervention of Great Britain, Germany and the United States, and in 1889 an agreement was made guaranteeing the neutrality of the islands, and placing each of these powers on an equal footing regarding trade and other matters. Further trouble arose, and an agreement was made for the partition of the islands between the United States and Germany. The United States obtained Tutuila and some smaller islands. After the World War German Samoa was mandated to New Zealand. It includes Upolu, 340 sq. mi. and Savaii, 650 sq. mi. See also AMERICAN SAMOA.

SAMOS, an island in the Aegean Sea off the coast of Asia Minor, about 27 mi. long and 14 mi. wide. The highest of its mountain peaks is Kerkis, 4,725 ft. Ionians settled the island. By 600 B.C. it had become politically powerful and founded several colonies. Such Mediterranean products as cocoons, raisins, oil, cotton and tobacco are grown to-day. From 1832 to 1912 the island was governed by a council of Greeks and a Prince of Samos, appointed by the Sultan of Turkey, to which country tribute was paid. In the latter year Greece annexed Samos. Pop. 1928, 70,497.

SAMOVAR, a vessel generally made of brass or copper, chiefly used in Russia for brewing tea. It is often chased or carved, with a graceful dome-shaped top. Water is kept at the boiling point by a cylinder 2 or 3 in. in diameter, filled with live coals, which passes through the vessel from top to bottom. The tea itself is placed in a porcelain or earthenware pot, filled with hot water from the samovar, and after serving is kept warm on top of the samovar. Of Tartar origin, the samovar is an important household article in Russia, where tea is the national drink.

SAMPAN. See BOAT.

SAMPHIRE (*Crithmum maritimum*), a smooth perennial of the parsley family with fleshy leaves of a salty spicy flavor used for pickling. It grows in clefts of rocks near the sea in western Europe, northern Africa and along the Mediterranean. The slightly woody stem, about a foot high, bears thick fleshy branches, foliage and flower-clusters. In North America various glassworts (*Salicornia* sp.) of similar form and habit are sometimes called samphire.

SAMPLE. In many problems in economics and sociology it is impossible or impracticable to make a complete enumeration of the entire population of the items in which the interest lies. In such cases conclusions are drawn from a selected sample of items. The essence of the process of sampling consists in selecting from the entire population a representative group. If this is done properly the measurements of the sample will give results which may be used to characterize the entire population. Care must be taken in the selection of the sample in order that it will be truly representative and that no bias may creep in to influence the results.

The size of the population to which the results are to apply and the character of the population will determine to a large extent the size of the sample that will be necessary in order to get a fair picture. The greater the population the larger must be the sample.

As a rule the sample is chosen by a process of random selection. However, the results secured by the analysis of successive samples do not always exhibit identical results. When the results secured from successive samples differ materially it is an indication that the original samples were either too small or were chosen in a manner that led to unreliable conclusions.

The reliability of the statistical summaries obtained from a given sample may be judged by calculating

their probable errors. By increasing the size of a sample the probable errors are decreased, and it is thus possible to reduce them to a point where they may be neglected.

D. H. D.

BIBLIOGRAPHY.—F. C. Mills, *Statistical Methods*, 1924.

SAMPLER, a piece of embroidery containing samples of different designs and stitches, especially applied to the work of a child whose newly acquired skill would be demonstrated thereby. In early times every little girl had to work a sampler, which was often framed and hung in a place of honor. One specimen, dated 1747, in the Metropolitan Museum of New York, has besides name and date the alphabet repeated several times in varied styles, 16 different border patterns, flowers, plants, trees, birds, boats, dogs, deer, dishes, keys, chair, pyramids, peacock and crucifix. Often Bible texts were included.

SAMPLING is the selection of small amounts of materials in order to determine quality or suitability for any particular use. Since the acceptance or rejection of a whole shipment may depend upon the selection of the sample, sampling becomes very important. Specifications for sampling many materials have been prepared by the AMERICAN SOCIETY FOR TESTING MATERIALS.

A sample must be truly representative of the material which will be actually used. It is therefore considered better practice to take small portions from many places in a supply than to take the sample from one place. In the case of materials flowing through a pipe, on an endless belt, or by gravity, it is possible to take sample portions regularly by mechanical means, thus eliminating the personal element.

In the laboratory the testing engineer must further reduce the sample in size and he also must exercise great care to keep the sample truly representative. Samples that might change their properties due to exposure to air, moisture, or heat, must be properly protected. *See also* MATERIALS TESTING; INSPECTION.

In mining, sampling is done by removing small quantities of ore by cutting channels across the ore at regular intervals, the cuttings being saved and assayed. Where sufficient ore exposures are available, a systematic sampling makes it possible to estimate the value of the available ore with fair accuracy. *See also* SALT-ING; MINE EXAMINATION; QUARTERING; ASSAY.

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SAMPSON, WILLIAM THOMAS (1840-1902), American naval officer, was born in Palmyra, N.Y., Feb. 9, 1840. He was graduated from Annapolis in 1861 where he served as instructor for a number of years (1861-63, 1868-71 and 1876-78) and as superintendent in 1886-90. He saw active duty in the latter part of the Civil War, being executive officer on the ironclad *Patapsco* when it was blown up by a mine off Charleston. He was made lieutenant commander in 1866, commander in 1874 and captain in 1889. Between his terms of teaching at Annapolis, he served at sea or in commands at foreign posts and for a time in charge of the Naval Observatory. From 1890 to

1892 he was captain of the newly built *San Francisco*, and from 1893 to 1897 chief of the Ordnance Bureau, where he rendered valuable assistance in building up a new navy. In the Spanish-American War, as acting rear-admiral, he commanded the North Atlantic squadron which blockaded Cervera's squadron in Santiago Harbor and destroyed the ships when they attempted to escape July 3, 1898. The first part of the battle was carried on by Commodore Schley in the absence of Sampson who had gone to confer with General Shafter, and who hastened back to the battle in time to engage the last of the Spanish ships. This battle served as a controversy between the two officers for a number of years. After the war, he was commissioner in Cuba, becoming rear-admiral, March, 1899. For the next two years he was in command of the Boston navy yard, and died in Washington, D.C., May 6, 1902.

SAMSON, traditionally believed to be the 15th judge of Israel. He was the son of Manoah of the tribe of Dan, and ruled Israel before the monarchy. The Bible relates that he drank no wine, did not cut his hair, was of enormous strength and played tricks on his enemies, such as tying firebrands to the tails of 300 foxes and driving them into the cornfields of the Philistines. In the end, with eyes put out by his foes, the blind giant leaned against the pillars of the hall in which they made merry and brought the house down so that he died with them. Because "Samson" means "sun man," some see in the story parts of a solar legend. Others think of Samson as a Hebrew Hercules. A hero, however, he yet remains, revengeful, sarcastic, strong, who may have been some ancient champion of the Danites. He is memorialized for the modern world by Milton's "Samson Agonistes" and Saint-Saëns' "Samson et Dalila."

SAMSON AGONISTES ("Samson the Combatant"), a dramatic poem by JOHN MILTON; published 1671. It is based on the Biblical story of Samson and is written in the form of a Greek drama. This sublime poem, Milton's last great achievement, tells of the revenge which Samson, blind and imprisoned by the Philistines, wreaks upon his old enemies when, grasping two of the supporting pillars of the temple of Gaza, he hurls them down, himself perishing also in the general ruin which follows. Manoa, Samson's father, is the chief secondary character, and there is a chorus composed of the hero's friends. By thus raising the simple Biblical story of Samson to the classic form and noble dimensions of a Greek drama, Milton created the most majestic poem of its kind in English. G. F. Handel's oratorio, *Samson*, produced 1743, is based on the poem.

SAMSON AND DELILAH, an opera in three acts by CAMILLE SAINT-SAËNS, libretto based on the biblical story by Ferdinand Lemaire; première, Weimar, 1877, New York, 1895. The work is also known as an oratorio, being often performed without a setting. It is the most popular of Saint-Saëns's dramatic works.

SAMSUN, a city of Asiatic Turkey and principal town of the Janik vilayet, located on the southeast coast of the Black Sea. The export outlet for the Sivas region, it is a prosperous town. A steamship route joins it to Constantinople and good roads are a means of communication with Sivas and Kayseri. There are no quays or landing facilities in the harbor and vessels anchor about a mile away. The ancient Amisus, a flourishing town under the kings of Pontus, was about a mile and a half northwest of Samsun. During the first century A.D. it became a prominent port of the Central Asian trade route. Samsun was likewise an important commercial center under the Comneni of Trabizon. Cereals and wool are the chief products of export. The region is noted particularly for the variety of Turkish tobacco which is called Samsun. Pop. 1927, 76,043.

SAMUEL, a Hebrew prophet, probably of the 11th and 12th centuries B.C. One story says he was of the tribe of Ephraim, but according to another he was of the tribe of Levi. He grew up at the shrine at Shiloh under the instruction of the High Priest Eli. His historical character is debated by some modern scholars, who believe that his traditions have been transmitted through different writers, who may have combined in their records the stories of more than one ancient hero. Samuel is presented in the Bible as the prophet who caused the Israelites to renew their faith in Jehovah, carrying on the work of Moses. He established "schools of the prophets," and when a warlike leader was demanded, reluctantly anointed Saul, the first king of the nation. After his break with Saul, however, Samuel secretly anointed David to be the king's successor. He died an old man at Ramah. The Books of Samuel owe their title to the fact that they open with the narratives of the prophet's life.

SAMUEL, BOOKS OF, in the Old Testament, owe their title to the name of the judge or prophet whose history is told in the early chapters. Originally they formed one book, the division being introduced in the Greek and Latin versions. In the Douay Bible they are called I and II Books of Kings, because the major part refers to the regal period of Hebrew history, while books called I and II Books of Kings in the Authorized version are denominated III and IV. The Books of Samuel relate the story of the Israelites from the birth of Samuel to the death of King David, covering a period of about a century. In the first book are the stories of Samuel and Saul and Saul's relations with David, while the second deals wholly with David's reign. From the structure and internal evidence, it would appear that the books were compiled from ancient sources, about the 5th and 6th centuries B.C., some sections being described as distinctly post-exilic. Their best-known stories are the killing of Goliath, the friendship of David and Jonathan, the story of the witch of Endor and the incident of David and Bathsheba.

SAMURAI, the members of the military class in feudal Japan, corresponding roughly to the knights in

European feudalism. The Samurai had a strict code of loyalty to their feudal superiors, of personal bravery, of devotion to duty and of indifference to wealth which they followed, on the whole, with notable care. When the feudal system was abolished following the Restoration of 1868, the Samurai as a class lost their means of livelihood and many of them fell into dire poverty. The members of the first modern police forces in Japan were drawn largely from among the Samurai.

SAN ANGELO, a city and the seat of Tom Green Co., western Texas, situated on the Concho River, 225 mi. northwest of San Antonio. Two railroads serve the city. Cotton, pecans and grains are the principal crops. Livestock is raised in the district, especially goats and sheep. Oil and gas are the natural resources of the region. Cotton products, oil and machinery are the chief local manufactures. The city is an important wool market. In 1929 the retail trade was valued at \$18,410,180. The city was founded in 1869 and incorporated in 1903. Ft. Concho, established in 1868, is still standing. The old Butterfield Trail, important in the early days of stage-coach travel between San Francisco and New York, passed near the city. Pop. 1920, 10,050; 1930, 25,308.

SAN ANTONIO, a city in south central Texas, the county seat of Bexar Co. It is situated on the San Antonio River, about 75 mi. southwest of Austin. Airplanes, bus and truck lines and three railroads serve the city. San Antonio is the third largest city in Texas, surrounded by farming and stockraising country, oil and gas fields. In 1929 the factory output was worth about \$52,000,000; the chief manufactures are candy, cigars, flour, clothing, iron, steel and cement. The wholesale trade proper for 1929 amounted to \$77,873,014; the retail business to \$123,052,214. San Antonio is a modern city whose tall buildings rise beside the quaint remains of the Spanish founders. The cathedral of San Fernando, dating from 1754, stands in the center of the city. The Alamo, originally part of a Franciscan Mission, and later used as a fort, faces the Alamo Plaza which was once the scene of public executions. From Feb. 23 to Mar. 6, 1836 it was held in a state of siege. The river and two creeks winding through the city, the palms, live oaks and pecan trees and the Mexican quarter give San Antonio a unique charm. The ruins of four handsome Franciscan Missions lie to the south. Ft. Sam Houston on Government Hill is the second largest military post in the United States. Other military reservations include a cavalry post, headquarters of the Eighth Corps Area and three aviation fields with two flying schools. The site was settled about 1718. San Antonio was originally a Spanish colony, passing under Mexican control about 1821, in which it remained until the war of Texas independence in 1836. In June, 1837, the city was incorporated under the Texas Republic. Pop. 1920, 161,379; 1930, 231,542.

SAN ANTONIO DE PADUA, the third Franciscan mission in California, was established July 14,

1771, by Father Serra in Los Robles Valley, 6 miles from the present town of Jolon in Monterey Co. The Indians of this mission belonged chiefly to the Salinan linguistic stock. According to mission archives there were also many neophytes from the San Joaquin Valley who were probably Yokuts. The greatest number of Indians attached to the mission at one time was 1,124, the number recorded in 1805. Up to 1834, a total of 4,348 natives had been baptized of which 2,587 were children. The mission was secularized the following year and thereafter rapidly declined. It remained in ruins until 1904 when the Landmarks Club of California undertook its restoration.

SAN BENITO, a city in Cameron Co., southern Texas, situated 20 mi. from Brownsville. Two railroads and bus and truck lines serve the city. There is a United States Department of Commerce intermediate airport here. San Benito is a trading center for the produce of this irrigated district; the chief crops are cotton, citrus fruits and winter vegetables. In 1929 the retail trade amounted to \$5,239,252. The principal industries are canning and box making. The city was founded in 1904 and incorporated in 1912. Pop. 1920, 5,070; 1930, 10,753.

SAN BERNARDINO, a city in southern California, the county seat of San Bernardino Co., situated at the entrance of the Cajon and San Geronimo Passes, 60 mi. east of Los Angeles. Bus and truck lines, three transcontinental and the Pacific Electric lines serve the city. The surrounding county, once desert land, but for many decades under irrigation, produces great quantities of citrus fruits, grapes, peaches, alfalfa and truck crops. The city has clothing, ice machinery, steel-casting and oil-well supply factories, railroad shops and other industrial plants. In 1929 the manufactured output was valued approximately at \$8,000,000; the retail trade reached a total of \$25,493,286. San Bernardino County is known for its deposits of gold, silver, borax, potash, lime and other valuable minerals located for the most part northwest of the San Bernardino Mountains. A party under Father Dumetz, a Spanish missionary, founded a mission supply station here in 1810. The Mormons laid out San Bernardino in 1851. The city was chartered in 1864 and re-chartered in 1905. Six miles distant are the famous Arrowhead Springs, located at the base of the historic natural Arrowhead landmark. San Bernardino is the gateway of the famous Rim of the World Drive, a paved, high-gear road, 1 mi. high and 101 mi. in length. Pop. 1920, 18,721; 1930, 37,481.

SAN BUENAVENTURA, the ninth Franciscan mission in California and the last to be founded by Father Serra, was established Mar. 31, 1782, within the limits of the present city of Ventura in Ventura Co. During the first decade of the 19th century it exceeded all of the missions in material prosperity due to its advantageous location which enabled it to command the Santa Clara and other rich valleys between the Santa Inez Mountains and the Pacific. The Indians attached to this mission were recruited almost entirely from the CHUMASHAN linguistic stock and,

according to mission archives, represented about 31 villages. The total number of baptisms up to 1834 was 3,805. After 1830 the mission declined and in 1846 the lands were sold for \$12,000.

SAN CARLOS APACHE, a large division of the APACHE Indians formerly living on the San Carlos River and generally in the region west of Globe, Ariz. They are now gathered on the San Carlos Reservation in southeastern Arizona.

SANCHEZ, FLORENCIO (1875-1910), generally regarded as the most original playwright yet produced by Spanish America, was born in Montevideo, Uruguay, Jan. 17, 1875, and died in Milan, Italy, Nov. 7, 1910, while on an official commission for his country. The oldest of 11 children, he received a common school education. As a clerk in the Junta Administrativa, he stole time for scribbling, and appeared in print in his 15th year, under the English pseudonym, "Jack the Ripper." He was by nature a journalistic Bohemian and supplied his lack of culture with a quick mind and a ready observation. From the beginning he showed marked ability in dialogue, so that his drifting to the stage was inevitable. By his 18th year he had developed anti-clerical beliefs; he took part in the Revolution of 1896. He traveled much between the sister cities of Montevideo and Buenos Aires, now in quest of work, now eluding the police. Sporadic attempts to found various periodicals failed, largely owing to Sanchez's irresponsibility.

The plays of Sanchez have generally been grouped as portraying either life in the country, life in the city, especially among the lower middle class, or 3 as dealing with contemporary problems. He is a realist first of all, and draws chiefly upon persons and scenes that he knows intimately. In *My Son The Doctor* (*M'hijo el doctor*, 1903, his most noted play), as in *Nuestros Hijos* (*Our Children*, 1908), he depicts the conflict between new ideals and old; in *La Gringa* he represents the conflict of the native who must yield up his holdings to the more efficient foreigner; in *Baranca Abajo* and *En Familia* he portrays a family falling away to moral ruin because of financial and political reverses. Himself a sick man, he had the courage to pen *The Rights of Health*, in which the thesis is a Nietzschean disregard of the weak. Sanchez's manuscripts, rarely revised, or even reread, or for that matter spelled correctly, unfold with stenographic rapidity. He is least successful when he attempts stylistic niceties. He shows the influence of José Echegaray, and also of HENRIK IBSEN; a touch of MAXIM GORKI and an element of the Grand Guignol are likewise to be detected. Despite these foreign influences Sanchez has a strong native savor. When, in *Los Muertos*, he studies the evil of drink, he may be taking from others the notion of the problem play, but the substance derives from his own life. His plays were produced chiefly in Buenos Aires. They are not literature, though they read often compellingly. They belong to the history of South American dramatic culture.

I. G.

See I. Goldberg, *The Drama of Transition*, 1922.

SANCHO PANZA, in Cervantes' *DON QUIXOTE*, the faithful squire and companion of Don Quixote. The master considers his squire rather stupid and insensitive to the higher things, but Sancho Panza is the embodiment of shrewd common sense.

SANCTIONS AND GUARANTEES, the means used to secure respect for international law and the fulfillment of treaties. Prior to the establishment of the LEAGUE OF NATIONS self-help by an injured state, or INTERVENTION by interested states were relied upon. The League Covenant provides for the severance of trade relations and the prohibition of all intercourse with a Covenant-breaking state, and suggests the collective use of military force as a last resort. The Locarno Treaty of Mutual Guarantee is also supported by a collective military sanction.

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SANCTUARY, the holy central place of worship in the ancient temples (*see* TEMPLE) of the Hebrew people, where the sacrifices were offered up on the altar to God, and where the sacred utensils used in the temple service were kept. The altar was one of the most characteristic features of the sanctuary, and was to be found in all the three temples of Hebrew history. In the days before Solomon built the temple at Jerusalem, about 970 B.C., the tabernacle of the wilderness period contained the sanctuary. After the entrance of the Hebrews into Canaan, the city of Shiloh, in the tribe of Ephraim, was selected as the place where the sanctuary was to be erected. (I Samuel 1:3.) Here the sons of Aaron and the Levites officiated, and here Eli was priest at the beginning of the life-story of the prophet Samuel; here, too, the sanctuary was located for many years until it was displaced by the temple at Jerusalem erected by Solomon. There were other sanctuaries at Nob, the city of the priests, and at Gibeon (II Chronicles 1:3), which served as shrines until Solomon's Temple was built.

Among all the ancient peoples the sanctuary was considered to be the prime place of refuge, an inviolable haven for those seeking the protection of the Deity. (Cf. I Kings 2:28-35; similar illustrations are frequent in Greek and Latin literature.) Those who violated its sanctity by doing harm to the people who had fled thither for refuge were deemed guilty of a heinous and irreparable wrong. This idea has given to the English word sanctuary its secondary meaning of place of refuge, haven of safety, and has produced the expression "to find sanctuary." A. SH.

See W. Caldecott, *The Tabernacle*, 1904.

SAND, GEORGE (1804-76), pen-name of Madame Amandine Lucile Aurore Dudevant, *née* Dupin, who was born in Paris, July 1, 1804. On her father's side she was descended from the celebrated Maurice de Saxe, and her grandmother, who brought her up, was a lady of the *ancien régime*. Educated in a convent, she married a country squire, Casimir Dudevant, in 1822; when her life with him became unhappy, she

left him, and, with her daughter Solange, settled in Paris. The income granted by the separation was insufficient for her support, and she turned to writing, working first in collaboration with Jules Sandeau, whose name was the basis for her *nom-de-plume*. Her first independent novel, *Indiana*, was published in 1832, and was speedily followed by *Valentine* and *Lelia*, all romantic arguments for social and marital freedom. In 1833 she accepted the literary advice of Sainte-Beuve, who remained a helpful critic, and in the same year she formed her celebrated intimacy with Alfred de Musset. In 1837 began her *liaison* with the composer Chopin. George Sand wrote tirelessly, turning later to pastoral themes. *Consuelo* was most prominent among her many novels, though almost as noted are *La petite Fadette* and *La Mare au diable*, 1846. After her succession of stormy, but undeniably genuine, romances, she spent her last years in rural quiet, cheered by intellectual comradeship with the great minds of the day. George Sand died at Nohant, June 8, 1876.

BIBLIOGRAPHY.—René Doumic, *George Sand*, English trans. 1910; M. H. Howe, *George Sand*, 1927; E. W. Schermerhorn, *The Seven Strings of the Lyre*, 1927.

SAND, loose, granular material of a certain size, rather than of a definite composition. The grain sizes included lie between one twentieth of a millimeter and one millimeter in diameter. Rock WEATHERING is normally the source of sands, but they are also produced by the grinding action of waves or currents. The resistant materials thus left may be transported by water, wind, or glaciers to form typical deposits, as beaches, sand bars and dunes.

Due to the resistance of QUARTZ to weathering and abrasion, the most abundant sands usually consist of quartz grains. Other substances may form sands, however, as dolomite, feldspar, gypsum, magnetite, coral, calcite, shale and garnet.

Quartz sand is used in making mortar and concrete, in filters, for road making, in glass manufacturing, and for making moulds in foundry work. GYPSUM sand serves the same purpose as gypsum in making plaster. GLAUCONITE sands make good fertilizer; MONAZITE sands are the source of some rare elements. Gold PLACERS are often found in MAGNETITE sands. Sand is very common and widespread. *See also* CLAY; GRAVEL; SANDSTONE; ARKOSE; ARENACEOUS; PETROLOGY.

SAND, in ORE TREATMENT, refers to the product of grinding ore and rock which is coarser than the slimes. The finest, or slimed portion, diffuses so thoroughly in water that precipitation is inhibited, but sands are coarse enough to precipitate readily.

SANDALWOOD, an island of the Dutch East Indies. *See* SUMBA.

SANDALWOOD (*Santalum album*), a small evergreen tree of the sandalwood family native to India. It yields a very hard, close-grained, yellowish-brown wood, prized for its lasting fragrance and much used in carving and cabinetwork. An oil distilled from sandalwood chips is valued in India for perfumery.

In China the wood is burned for incense. The name sandalwood is applied to other species of *Santalum* and to various unrelated trees with a somewhat similar wood, as the red sandalwood (*Pterocarpus santalinus*), native to the East Indies, used as a dye-stuff.

SAND BINDING PLANTS, various perennials with strong vigorous roots or rootstocks grown upon dunes and other exposed sands to prevent wind erosion. In the United States the most important sand binder is the MARRAM or beach grass (*Ammophila arenaria*). Several other plants are used locally for sand binders, as the HOTTENTOT FIG (*Mesembryanthemum edule*) grown on dunes in southern California.

SAND BLASTING, a method of cleaning by which an ABRASIVE is forcibly thrown on an object to be cleaned by the blast of COMPRESSED AIR. Small particles of steel, known as "steel shot," are used to clean rough castings while for removing the scale from finished work sand is used. Where a very slight abrasive action is desired a very fine wet sand is used, this being sometimes called a "mud" blast. The operator may direct the hose of the sand blast manually, wearing a "mask" for protection. For some sand blasting the work is placed on a moving table that carries it under several jets in an enclosed portion of the machine. Sand blasting is also used in cleaning the outside of buildings.

SAND BUR, a name given in the United States to various weedy plants with prickly or spiny flowers and fruits, native chiefly to dry sandy soil. Among these are the buffalo-bur (*Solanum rostratum*), found from South Dakota to Texas and Mexico and occasionally in the eastern states; Hooker's Gartneria (*Franseria acanthicarpa*), found from Saskatchewan to Texas, westward to British Columbia and California, and the bur-grass (*Cenchrus* sp.). The burro-weed (*Franseria dumosa*), common in western deserts, is also called sand bur.

SANDBURG, CARL (1878-), American poet, was born at Galesburg, Ill., Jan. 6, 1878. He received little schooling in his youth, but after his return from active service in the Spanish-American War, he entered Lombard College, Galesburg, where he remained until 1902. He edited various mid-western publications, wrote for the magazines and served as secretary to the mayor of Milwaukee. *Chicago Poems* appeared in 1915, *Corn Huskers*, 1918, *Smoke and Steel*, 1920, and *Slabs of the Sunburnt West*, 1922. Sandburg gave to verse a new technical freedom, fresh vitality, and demonstrated like WALT WHITMAN that the crude and common sides of American life afford the poet material that is genuinely native and potentially beautiful. His prose works include *Abraham Lincoln, the Prairie Years*, 1926, and *Abe Lincoln Grows Up*, 1928. See also VERS LIBRE.

SAND CRICKET or Jerusalem cricket, a popular name for certain species of wingless cricket-like grasshoppers (subfamily *Stenopelmatinae*). They are large headed, thick legged, clumsy creatures abundant in

the Pacific coast states. They are not known to do any damage. They are partly carnivorous.

SAND DOLLAR, the popular name for members of a genus of the echinoderm order of flat sea urchins (*Clypeastroidea*). The common sand dollar (*Echinarrachnius parma*) lives in shallow, sandy, places along the Atlantic coast of the United States, and is most numerous around New England and New Jersey. It has a hard, roundish, and greatly flattened shell or test from 2 to 3 inches in diameter. While alive it is covered with reddish brown spines, which come off easily when it is dead. Then a beautiful design, like a five-petalled flower pricked on the surface of the test is revealed. The holes which form the pattern are the passages through which the tube-feet or podia are connected with the hydraulic system in the living animal. In the sand dollar these podia are used in breathing. See also SEA URCHIN.

SANDEFER, JEFFERSON DAVIS (1868-), American educator, was born in Sharp Co., Ark., May 13, 1868, and educated at Parker Institute, Whitt, Tex. He was president of Strawn College, Texas, from 1894-1900; professor of Latin and history from 1902-07 and president from 1908-09 of John Tarleton College, Stephenville, Tex. In 1909 Sandefer became president of Simmons College, Abilene, Tex. Under his administration the latter institution was expanded into a university.

SANDERLING (*Crocethia alba*), one of the smaller and the whitest of the sandpipers. It is about 8 in. long, rusty spotted with blackish above and white below. Frequenting sandy beaches it breeds in the northern regions from Iceland to Alaska and Siberia, wintering southward along the coasts to the extremity of South America, Africa and Australia. Its gathers in small flocks at the water's edge to feed upon various aquatic animals left by the retreating waves, and builds a rude nest on the ground, laying three or four spotted light olive brown eggs. Its note is a thin, rather plaintive whistle.

SAND-FLY, a popular name for certain biting midges of the family *Chironomidae*, known also as punkies and no-see-ums. See MIDGE.

SANDFLY FEVER, a disease caused by the bite of sandflies, and due to an ultramicroscopic germ. It occurs on the eastern Mediterranean coast. The disorder appears from one to six days after the bite, starting with severe headache, fatigue and general pains. The temperature rises within twenty-four to thirty-six hours to a point as high as 104° F. The disorder lasts three days. As the temperature drops, there may be sweating, vomiting and diarrhea. There are no complications and the disorder is never fatal. There may be some weakness following the disorder.

Sanitary measures diminish the prevalence of sandflies and in this way prevent the disease. See also TROPICAL MEDICINE.

SAND GROUSE, the common name for an Old World family (*Pteroclidæ*) of about 20 species of somewhat grouselike birds allied to the pigeons. Sand grouse are widespread in Europe, Asia and Africa and

usually winter in Africa, frequenting mostly bare plains and deserts. They are about a foot long and yellowish brown or buff in color, with fowl-like bills, long pointed wings and very short legs and toes. They usually move in small companies, but sometimes congregate in immense flocks, feeding upon seeds, tender shoots, insects and berries. On the bare ground or in a very slight depression they lay usually 3 spotted gray or greenish eggs, both parents assisting in incubation. Their notes are shrill whistles, twitterings or cluckings. Although ranked as gamebirds sand grouse have hard, flavorless flesh. Among the best known are Pallas's sand grouse (*Syrrhaptes paradoxus*) of Asia, occasionally invading Europe in great numbers, the pin-tailed sand grouse (*Pteroclorus alchatus*) of southern Europe and Africa, and the painted sand grouse (*Pterocles fasciatus*) of India.

SANDHURST, a town of Berkshire, England, about 30 mi. southwest of London. Sandhurst Royal Military College, established in 1802 at Great Marlow, and later removed to its present fine situation, trains cadets entering by competitive examination for commissions in various corps of the British army. A new chapel, erected in 1922, commemorates 4,000 cadets lost in the World War. Pop. 1931, 3,800.

SANDHURST. See BENDIGO.

SANDIA, a pueblo and Indian tribe, speaking the Tigua dialect of the Tanoan linguistic stock. The pueblo is situated on the east bank of the Rio Grande about 12 miles north of Albuquerque. During the Pueblo Revolt it was deserted and burned, and the tribe fled to join the Hopi in northeastern Arizona. At the instigation of Father Juan Miguel Menchero the Sandia returned in 1748 and built a new pueblo on the old site.

SAN DIEGO, a port city in southernmost California, the county seat of San Diego Co., situated on the crescent-shaped San Diego Bay, 10 mi. from the Mexican border and 130 mi. south of Los Angeles. Airplanes, ocean-going steamers, bus and truck lines and two railroads afford transportation. The landlocked harbor is the first American port of call for vessels sailing west through the Panama Canal. Its traffic, 1930, was worth \$49,748,000. San Diego has many industries; fishing, canning and packing are the most important. There are wholesale houses, shipyards and factories making a variety of products. In 1929 the factory output was worth about \$34,000,000; local retail trade amounted to \$94,414,236. The naval base is the largest on the Pacific Coast, with nearly 5,000 officers and men on the payroll; it is equipped with a naval air station, fuel and supply depots, marine and destroyer bases and a training station. Located here are an Archaeological Institute and the replica of a Pueblo Indian Village, both in Balboa Park, and a State Teachers College. Near by, at La Jolla, is the Scripps Institution of Oceanography. The bay was discovered by Cabrillo, a Portuguese adventurer, in 1542. The first white settlers came in 1769, and the first Franciscan mission in California was built here in 1769 by Padre Junipero Serra. The

city was chartered in 1850. The Spirit of St. Louis, Col. Charles Lindbergh's famous plane, was built in San Diego, and 42 world records in aeronautics have been accomplished here. Pop. 1920, 74,361; 1930, 147,995.

SAND LAUNCE, the name for a small family (*Ammodytidae*) of slender, somewhat eel-like, spiny-rayed fishes abundant along ocean shores in northern regions. They are of very small size, with toothless jaws, many transverse folds of skin on the body, very long, low dorsal and anal fins, and a deeply forked tail-fin. Moving in large schools close to shore they bury themselves with astonishing rapidity in the sand above low water mark in order to escape from their enemies or to await the return of the tide. Sand launces are excellent pan fishes, are much used for bait, and furnish a substantial part of the food of many larger fishes and other aquatic animals. The common sand launce (*Ammodytes americanus*), about 4 in. long, is found from Cape Hatteras to Labrador; the Pacific sand launce (*A. personatus*) is well-known on the shores of California, Alaska and Japan.

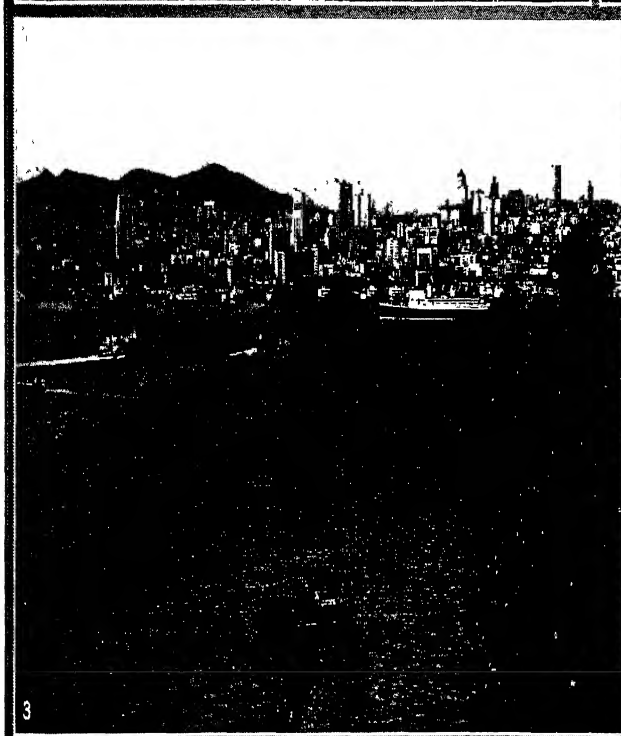
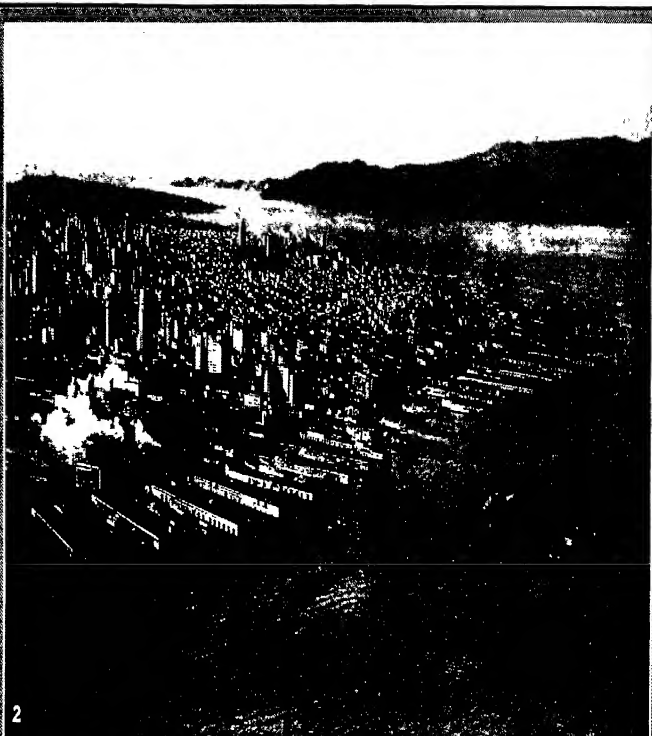
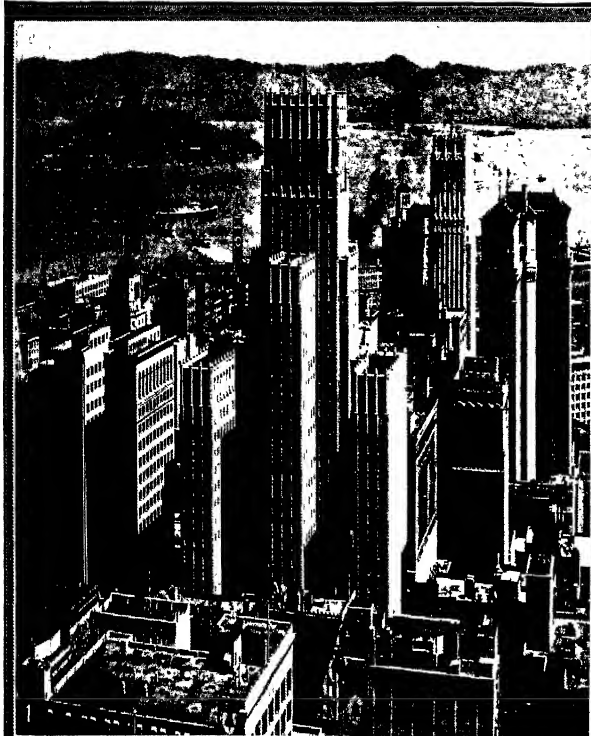
SAND LILY (*Leucocrinum montanum*), an attractive early wildflower of the lily family, native to sandy soils in the western United States. The short rootstock, from which spring cordlike roots, gives rise at the surface of the ground to a tuft of somewhat grasslike leaves and a cluster of showy, pure white, fragrant flowers with a long slender tube terminating in a six-parted limb.

SAN DOMINGO. See SANTO DOMINGO and DOMINICAN REPUBLIC, History.

SAND PAPER, a strong type of paper coated first with glue and then with particles of sharp grained sand, varied in size to give a fine or a coarse surface. It is used by wood workers for smoothing surfaces or for removing paint or other substances. See also GLASS PAPER.

SANDPIPER, a name given to various small shore birds of the family *Scolopacidae* because of their low piping notes and their habit of running about on the sand. In the same family are the woodcocks, snipes, curlews, yellowlegs, dowitchers and godwits, some of which are still considered game birds. Fifty-six species of the family have been recorded in North America and most of them are of very wide distribution, breeding chiefly within the arctic circle and migrating to temperate regions in winter. They are mostly less than a foot long, with moderately long neck and legs, a very short tail, and a rather long bill. Their plumage is usually streaked with gray, brown or blackish above and whitish below, but some species become more brightly colored during the breeding season. Often going in large flocks, sandpipers frequent the seashore, marshes or banks of streams, where they probe with their bills in the soft earth for the aquatic insects, worms, small crustaceans and mollusks upon which they feed. They lay usually three or four eggs, buff or olive spotted, in shallow nests on the ground.

Representative North American species are the spotted sandpiper (*Actitis macularia*), one of the most

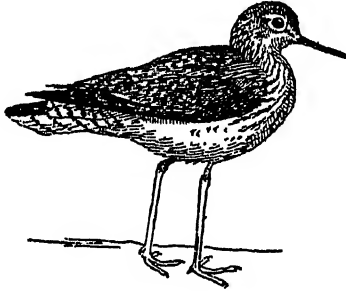


COURTESY OF CALIFORNIANS, INC.

SKY LINE VIEWS OF SAN FRANCISCO AND ITS HARBOR

1. The financial district with Goat Island in the left background.
2. An airplane view of the city, looking toward the Golden Gate.
3. A scene from mid-bay, showing the skyscrapers near the water front.
4. Trans-Pacific liners at dock along the Embarcadero.

common and widespread of North American shore birds, often called "tip-up," wintering southward to Brazil and Peru; the least sandpiper (*Pisobia minutilla*), barely 6 in. long, and the semipalmated sandpiper (*Ereunetes pusillus*), both nesting in Northern



G. M. SUTTON, "BIRDS OF PENNSYLVANIA"

SOLITARY SANDPIPER
Tringa solitaria

Canada and wintering from the southern states to South America, and the western sandpiper (*E. mauri*), found west of the Rocky Mountains. A. B. J.

SAND RIVER CONVENTION. The attempts of the British authorities in South Africa to exercise some control over the Boers who had trekked northward across the Vaal River after the defeat of Andries Pretorius near Boomplatz in Aug. 1848, involved these authorities in a series of annoying and costly quarrels, both with the determined and obstinate farmers and with the natives whose land was being appropriated by the immigrants. A climax in the difficulties was reached in the eighth Kaffir War, of 1850-51, after which the British decided to rid themselves of responsibilities which, on the whole, were "not merely worthless but pernicious." On Jan. 17, 1852, therefore, representatives of the English and the Boers signed the Sand River Convention whereby the British vouchsafed "to the emigrant farmers beyond the Vaal River, the right to manage their own affairs, and to govern themselves without any interference on the part of Her Majesty the Queen's Government." In Feb., 1858, the original name Transvaal Republic was changed officially to South African Republic.

See E. Hertslet, *The Map of Africa by Treaty*, 3 vols., 1909.

SAND SPRING, a city in Tulsa Co. situated in northeastern Oklahoma on the Arkansas River about 5 mi. west of Tulsa. The city is in the vicinity of some of the finest oil fields in the world and is an important industrial center, manufacturing cotton goods, glass, and chemicals. Smelting and oil refining are also engaged in extensively. Sand Springs was founded in 1911 and chartered in 1918. Pop. 1920, 4,076; 1930, 6,674.

SANDSTONE, a compacted and cemented form of siliceous, or quartz sand which amounts to about twelve per cent of the total SEDIMENTARY Rocks of the earth's surface. On the one hand the sandstones grade into the sands with decreasing coherence, on

the other into the QUARTZITES with increasing compactness, and strength and crystallinity of the siliceous cement.

Other substances besides silica may cement the quartz grains, such as calcite, limonite, hematite, and clay. Sandstone is mostly quartz, but feldspar, mica, garnet and magnetite may occur, as they do in quartz sands.

In color, these rocks vary from white, through gray, buff, and red, to brown. When iron oxide forms the cement the color is yellow or red; if it is calcite, then some shade of gray. A pure quartz sandstone is white. Various varieties of sandstone are named according to particular characteristics; siliceous composed mostly of quartz; ferruginous, with an iron oxide cement (brownstone); feldspathic sandstone, or ARKOSE, when much feldspar is present; grit, if it is particularly coarse; flagstone, when it is thinbedded and can be easily split into slabs suitable for flagging. Itacolumite is a micaceous sandstone of remarkable flexibility.

Sandstone finds wide application as a building-stone, as an abrasive used for millstones, buhrstones, whetstones, and grindstones. Silica brick and furnace linings are made of it, and it is much used in paving blocks and curbing. Glass sand is often ground up sandstone.

Sandstone is widely distributed, but the principal domestic production comes from Pennsylvania, Ohio, and New York. See also STRATIFICATION; PETROLOGY. S. F. K.

SANDSTORM, an exceedingly hot and dry desert wind of great strength, of the cyclonic type which often carries with it a pillar-like structure of sand, whipped up from the desert. Although the sandstorm rarely lasts more than a quarter of an hour, the combination of its speed, heat and dryness may sometimes prove fatal to animals and human beings.

SANDUSKY, a city of northern Ohio, the county seat of Erie Co., on Sandusky Bay, an inlet of Lake Erie, about 61 mi. west of Cleveland, 52 mi. east of Toledo and 116 mi. north of Columbus. Transportation facilities include the Baltimore and Ohio, New York Central, Nickel Plate and Pennsylvania railroads, steamboat and bus lines and an airport. The city is a port of entry and carries on considerable trade with Canada. There are important fresh-water fish interests. Peaches, grapes, apples, potatoes, wheat and corn are among the agricultural products. The principal manufactures include corrugated boxes, fertilizers, iron and steel castings, crayons and chalks. In 1929 the value of the manufactures was about \$14,000,000; the retail trade amounted to \$15,481,601. Cedar Point with its fine bathing beach, Put-in-Bay and other nearby points are delightful summer resorts.

Thomas A. Edison was born in the vicinity. The United States maintains a fish hatchery at Put-in-Bay. The city is the seat of the state soldiers' and sailors' home. On Johnson's Island in Sandusky Bay a Confederate Cemetery is located.

A fort erected in 1763 was destroyed the same year by the Indians. From Sandusky Bay Commodore Perry sailed in 1813 to win the Battle of Lake Erie. A permanent settlement was made in 1816 and in 1823 Sandusky was incorporated. Pop. 1920, 22,897; 1930, 24,622.

SAND VERBENA, a numerous genus (*Abronia*) of annual and perennial herbs of the four o'clock family. There are about 50 species, native chiefly to western North America, a few of which are grown



FROM JEPSON. MAN. FL. PLANTS CALIF., COPYRIGHT

HAIRY SAND VERBENA
Fruit and flowering branch

in borders, in rockeries and as basket plants. They are mostly prostrate but sometimes erect plants with more or less viscid herbage, bearing thick opposite leaves and numerous fragrant flowers in long-stalked heads surrounded by leafy bracts. In appearance the showy flowers, which range in color from red to yellow and white, somewhat resemble those of the verbena. Several are characteristic beach plants, as the common sand verbena (*A. umbellata*), the yellow sand verbena (*A. latifolia*) and the red sand verbena (*A. maritima*), found along the seashore from California northward; others abound in sandy deserts, as the hairy sand verbena (*A. villosa*), which at flowering time covers large areas in the Colorado Desert with purple bloom.

SANDWICH ISLAND, also known as Vate, Fate and Efate, is situated in the Pacific Ocean, and belongs to the group known as the New Hebrides. It is one of the most important ones of this group and contains Vila, a leading port and seat of administration of the island group.

SANDWICH ISLANDS. See HAWAII.

SANDWORM, a name commonly given to any worm which lives in the sand, and especially to a species (*Sabellaria vulgaris*) of marine bristle-worm (Polychaeta), that builds itself tubes of sand in which it lives. The sandworm is found from low water mark to a depth of 60 ft. on the eastern coast of the United States, between North Carolina and Cape Cod.

SANDY HOOK, a narrow peninsula, extending northward approximately 6 mi. from Monmouth Co., N.J. It lies between Sandy Hook Bay and the At-

lantic Ocean, and juts into lower New York Bay. On its northern point, about 15 mi. south of Manhattan Island, stands a lighthouse. Fort Hancock and the U.S. experimental grounds for heavy ordnances are also located at Sandy Hook.

SANDYS, SIR EDWIN (1561-1629), English statesman, was born in Worcestershire, 1561. He was educated at Oxford, later was a member of Parliament, and was knighted by James I. During his travels in Europe he became interested in religion and wrote *Europae Speculum*. He was active in many commercial enterprises like the East India Company, and was at one time treasurer of the Virginia Company. He died Oct. 1629.

SAN FELIPE, a pueblo and tribe of the North American Indians belonging to the Keresan linguistic stock. San Felipe is situated on the west bank of the Rio Grande about 12 miles above Bernalillo, in north central New Mexico. Previous to the coming of the Spaniards, the ancestors of the San Felipe and Cochiti formed one tribe and occupied several pueblos, successively abandoned, the last one being Kuapa, but they were separated by the aggressive Tewa. San Felipe took an important part in the Pueblo Revolt of 1680.

SAN FERNANDO, a city in Los Angeles Co., southern California, 22 mi. north of Los Angeles, served by buses and the Southern Pacific Railroad. The United Airport is six miles distant. The city is surrounded by citrus fruit orchards, vineyards and walnut groves. San Fernando Mission was founded in 1797, the seventeenth mission of the chain established by Spanish missionaries along the Pacific Coast. At this mission a pageant, Prayer of the Padres, is given annually. The city was settled in 1874; incorporated in 1911. It is the seat of a United States Veterans' Hospital. Near by is Pacoima Dam, completed in 1929, and at that time the highest dam of the constant angle type in the United States. Pop. 1920, 3,204; 1930, 7,567.

SANFORD, a city and the county seat of Seminole Co., in eastern central Florida, situated on Lake Monroe at the head of navigation on the St. John's River. The city is about 30 mi. from the Atlantic Ocean and about 125 mi. south of Jacksonville. It is served by the Atlantic Coast Line Railroad, and by steamships and buses. Sanford is a popular winter resort in a region famous for its great cypress trees. Large crops of celery and citrus fruits are shipped from the metropolis. Sanford has crate and lumber mills and railroad shops. The retail trade in 1929 reached a total of \$4,216,698. The city was founded about 1871 and incorporated in 1877. Sanford was swept by fire in 1887. The first citrus fruits in the state were raised here. Pop. 1920, 5,588; 1930, 10,100.

SANFORD, a town containing two villages, Sanford and Springvale, in York Co., southwestern Maine. It is situated on the Mousam River, 36 mi. southwest of Portland; served by the Boston and Maine Railroad. The Sanford airport was opened in July, 1930. Garden crops are the chief agricultural products. The

SAN FRANCISCO

village of Sanford has factories making worsteds and shoes. Springvale village is the seat of Nasson Institute, a girls' school. Sanford was founded in 1717 and incorporated in 1768. Pop. of town, 1920, 10,691; 1930, 13,392.

SAN FRANCISCO, chief port of California and of the Pacific Coast, and the 11th city in population of the United States, is situated on a peninsula washed on the west by the Pacific Ocean, on the north and east by the waters of San Francisco Bay, which forms a landlocked harbor, and bounded on the south by San Mateo Co. The city, coextensive with San Francisco Co., is at 37° 47' 22-55" N. lat. and 122° 25' 40-76" W. long. and covers an area of 42.19 sq. mi. It is 411 mi. northwest of Los Angeles and 773 mi. south of Portland, Ore. The 1920 population was 506,676, but in 1930 it reached 634,394, an increase of 25.2% in 10 years. In January the average temperature at San Francisco is 50° F., in July 58° F. The average annual precipitation is 22 in.

Geographic Setting. The site of the city is extremely hilly and attains a maximum altitude of 956 ft. The chief hills on the peninsula are Telegraph, Russian, Nob, Rincon, Bernal Heights, Potrero, Twin Peaks, Mt. Davidson and Lone Mountain. The summits overlook the Bay of San Francisco, which extends from Golden Gate Strait, the entrance from the Pacific, to the confluence of the Sacramento and San Joaquin rivers on the northeast, and south to a point near San Jose, a water area of 450 sq. mi. *See also* GOLDEN GATE. On the east side of the bay are OAKLAND, 6 mi. from San Francisco, ALAMEDA, BERKELEY and RICHMOND. On the San Francisco side and south of the city are the communities of Burlingame, San Mateo and Palo Alto. North of the city, across the Golden Gate, are San Rafael, Sausalito and San Anselmo. These communities are connected to the city by a system of ferryboats, and in 1930-31 "airplane ferries" were in service between Oakland and San Francisco. The harbor, comprising the bay shore along the eastern line of the city, has 17 mi. of berthing space, which include 49 modern piers and 7 dry-docks. The city is a port of call for 165 steamship lines. San Francisco Bay is the natural gateway to the valley of California. During the days when gold was being discovered in California, San Francisco grew into a seaport, and with the increase in population more trade came to the city. Since 1914 the growth of San Francisco in shipping importance has been greatly accelerated by the opening of the Panama Canal.

Few ports in the western hemisphere have a more romantic aspect. From the Pacific side the city presents a picture of successive hills, with Ft. Winfield Scott and Ft. Mason in the immediate foreground. At the entrance to the bay is Alcatraz, a fortified island. The business section is in northeast San Francisco, which presents a broken line of skyscrapers from the bay. The chief business artery is Market Street, a diagonal thoroughfare running from the ferry slips on the northeast shore, southwest through

the heart of the city. Since the earthquake and fire of 1906 the city has been rebuilt, and in the main the streets follow the direct points of the compass. The Civic Centre, under development since 1914, consists of the classic City Hall, a 4-story domed structure costing more than \$4,000,000, the Public Library, a building designed in Italian Renaissance style, the State Building, Municipal Auditorium and the War Memorial group of buildings, under construction in 1930, consisting of American Legion halls, an opera house and an auditorium. Other noteworthy buildings are the United States Mint at Fifth and Mission streets, the Ferry Building and the California Palace of the Legion of Honor situated in Lincoln Park and overlooking the Golden Gate; in Golden Gate Park are the De Young Memorial Museum, Academy of Science, Steinhart Aquarium and the Museum of Anthropology. In 1932 the Palace of Fine Arts Building of the 1915 Panama Pacific Exposition was restored by the park commission. The park system covers 2,842.14 acres, exclusive of the Presidio, the Federal military reservation commanding the southern side of the Golden Gate.

The Medical School, Hastings College of the Law, and colleges of Dentistry and Pharmacy, all affiliated with the University of California are located in San Francisco.

Commerce and Transportation. San Francisco's superb natural harbor and excellent docking facilities under state control have helped to give the city 4th place among United States ports in total value of imports and exports, amounting to 12,886,116 tons valued at \$1,484,683,671 in 1930. All industrial commodities including printed and published matter, coffee and spices, meat products, baked goods, motor vehicles, clothing, and foundry and machine shop products were valued approximately at \$475,000,000 in 1929. In the same year the retail trade amounted to \$499,060,416; the wholesale trade proper, to \$736,790,713. In 1930 the wholesale trade, all establishments, was valued at \$1,784,174,952. In addition to its facilities for water transportation the city is a terminus of three transcontinental lines, the Southern Pacific, Western Pacific and the Santa Fé. A municipal street railway is one of three transportation systems inside the city. The municipal airport at Mills Field is a terminus of the transcontinental air network. The chief bridges are the Carquinez Straits Bridge, at the northeastern end of the bay, and the San Francisco Bay Toll Bridge, between Little Coyote Point and Mount Eden. In 1930 citizens voted \$35,000,000 to defray construction of a bridge across the Golden Gate, to be the longest suspension bridge in the world. The same year plans were laid for a bridge between San Francisco and Oakland, by way of Yerba Buena Island, midway between the shores.

History. The Spaniards established a military post near the northern end of the peninsula in 1776. In 1844 there were only a dozen houses and about 50 inhabitants. In 1845 the American flag was raised over the post, and three years later the gold rush set a

premium upon the land, and a city of shacks and tents arose almost overnight. A series of disastrous fires, together with the inevitable economic reaction visited upon "boom" towns, halted its growth, but the city charter of 1856 established order. After the eastern railroads reached San Francisco, the city's commercial growth was rapid and continued until the catastrophe of Apr. 18, 1906, when a violent earthquake, followed by devastating fire, destroyed the business section. Generous sums for relief were subscribed throughout the nation, and the modern city was reconstructed in a remarkably brief period.

SAN FRANCISCO, UNIVERSITY OF, a co-educational institution in San Francisco, Cal., founded in 1855, as St. Ignatius College, and conducted by the Jesuit Fathers. The present name was adopted in 1930. There are day and evening divisions. The day schools comprise courses in arts and sciences, commerce, and finance, and pre-legal, pre-medical and pre-engineering courses. The evening departments include the School of Law, established in 1912, and commerce, finance, pre-legal and extension departments. A preparatory school is also maintained. The grounds and buildings were valued in 1931 at \$1,876,495. The library contained 44,736 volumes. In 1930 the student body numbered 1,273, and the faculty of 70 was under the presidency of the Rev. Edward Whelan.

SAN FRANCISCO DE ASIS, the 4th Franciscan mission established in California, Oct. 9, 1776, within the site of the present city of San Francisco and commonly known as the Dolores Mission. The group of Indians assembled came from tribes speaking dialects of the Costanoan linguistic stock. A distinct dialect was developed and the Indians were known as the San Francisco Mission Indians. The number of baptisms were exceeded only by San Jose but the mission population was kept down by an unusually high rate of escapes and deaths. A portion of the neophytes were transferred to San Francisco Solano mission in 1823 and the Dolores Mission thereafter steadily declined. When the mission was secularized in 1834 there was little property left, and in 1843 eight aged Indians, the sole remnant of the San Francisco group, appealed to the government for help.

SAN GABRIEL, a residential town and tourist resort in Los Angeles Co., southern California, 10 mi. northeast of Los Angeles. Buses, airplanes, the Southern Pacific Railroad and the Pacific Electric Railway afford transportation. San Gabriel is surrounded by splendid fruit growing, farming and dairying country. The site was settled by Franciscan missionaries, a mission being built in 1771. San Gabriel was incorporated in 1913. Every year the famous Mission play attracts thousands of visitors to the town. A beautiful Mission Playhouse has been built, at a total cost of \$1,000,000. Within the playhouse grounds is an enormous grapevine, reputed to be more than 200 years old. San Gabriel is the supposed birthplace of Helen Hunt Jackson's "Ramona." Pop. 1920, 2,640; 1930, 7,224.

SANHEDRIM or **SYNEDRIUM**, the Jewish priestly council sitting at Jerusalem under the Greeks, in the time of Antiochus the Great and under the Hasmonean high priests and princes. Its judicial authority varied with the degree of self-government accorded to the Jews under the various rulers to which they were subject. Under the Roman procurators, for example, the Sanhedrim was the highest judicial body of Jerusalem and was presided over by the Chief Priest, but the court did not have the power of life and death. The Sanhedrim exercised considerable authority over the Jews outside of Jerusalem.

SANICLE, a genus (*Sanicula*) of perennial and biennial herbs of the parsley family. There are some 40 species, found in every continent except Australia, about 15 of which occur in North America. They are mostly smooth erect plants, 1 to 4 ft. high, with more or less divided leaves, and yellow, white or purplish flowers in compound umbels. The small burlike fruits are usually covered with hooked bristles which aid in their dissemination by animals.

SAN ILDEFONSO, a Tewan pueblo and tribe of the North American Indians speaking a dialect of the Tanoan linguistic stock. The pueblo is situated on the east bank of the Rio Grande, 18 miles northwest of Santa Fe, N.M. Like the other Rio Grande pueblos, San Ildefonso played an important rôle in the Pueblo Rebellion of 1796, refusing to surrender until after a fourth attack by the Spaniards. Under a veneer of Catholicism, accompanied by the use of white man's utensils, implements and clothing, the San Ildefonso at present continue to live in large measure as they did in aboriginal days, with the same dual social organization, performing their sacred ceremonies, practising agriculture and making pottery, an art which has recently received a new impetus.

SANITARY ENGINEERING, the creating of favorable conditions for the preservation of the health of mankind and for ministering to their comfort and convenience, especially where they are congregated in cities and towns. The isolated individual in temperate climates finds pure water and uncontaminated atmosphere naturally provided and there are none to be injured or discommoded by his waste products. But in communities, ample pure water must be continually provided by a common technical agency. Waste products must be removed and rendered harmless in a proper manner. Wet lands produce unfavorable conditions and are drained for the sake of the general community health, and to improve agriculture. Disease bearing and discomforting insects are adverse to community welfare and society should provide for their exterminating. The incineration of foreign matter, and the smoke, gases and odors thereby released into the atmosphere, can be avoided only by organized effort and the improvement of the technological processes responsible.

To meet these demands engineering has developed **WATER SUPPLY** and purification, **SEWERAGE** and **SEWAGE TREATMENT**, **REFUSE DISPOSAL**, public cleansing of **STREETS**, mosquito and insect control and **AIR**

CONDITIONING and VENTILATION, which as a group constitute sanitary engineering.

Each of these matters has become important as cities have increased in size and are being made more perfect technically as increasing density of population and greater urban areas impose more stringent conditions.

As these services are for the common welfare, the responsibility for them is usually placed on the already constituted public agencies in cities, state and nation and they constitute a very large part of "public work." In their initial form they are often assigned to private enterprise and as such fall under the designation of PUBLIC UTILITIES.

W. W. H.

SAN JACINTO, BATTLE OF, Apr. 21, 1836, the decisive victory in the struggle of Texas to wrest its independence from Mexico. Gen. Santa Anna, president of the Republic of Mexico, with 1,360 troops, encamped on the San Jacinto River near its entrance into Galveston Bay, was attacked by a force of about 800 Texans under Gen. SAM HOUSTON, who disregarded strategic tactics and charged with such vigor that the Mexican troops were routed without serious resistance. Gen. Houston reported 630 Mexicans killed and 730 captured, including the wounded; the Texan casualties were two men killed and 23 wounded. Santa Anna fled from the field of battle but was captured the next day. He was released after he had agreed to withdraw the Mexican armies from Texas and to use his influence to secure a recognition of the independence of Texas with the Rio Grande for its boundary.

SAN JOAQUIN RIVER, a river of California, rising high in the Sierra Nevada Mountains just south of Yosemite National Park. In the first 125 mi. of its course it flows southwest through the mountains and along the northern border of Fresno Co. into the great central valley of California. Here it receives the waters of the Tulare system of lakes through Kings River, after which its direction changes to northwest. The second part of its course, covering 225 mi., intersects Merced, Stanislaus and San Joaquin counties and in the latter the river joins the Sacramento at the east end of Suisun Bay. Of its tributaries the largest are the Fresno and Merced which flow through the Yosemite Valley, and the Tuolumne and Stanislaus, all of which drain the western slope of the Sierra Nevadas.

The San Joaquin Valley covers an area about 30 mi. wide and 200 mi. long. It is noted for its fertility and for its immense crops of fruit and grain. Originally an arid and barren region, it has been developed by irrigation into one of the most productive sections of California. There are more than 35 separate irrigation projects in the valley, serving about 2,000,000 acres and varying in size from 1,033 to 330,000 acres which is the extent of the Madera Co. development. Other large projects are the Merced, serving 185,682 acres from water stored by the Exchequer Dam on Merced River; the Modesto and Turlock projects in Stanislaus Co., supplying 256,082 acres from the Pedro Dam and Reservoir on the Tuolumne River; and the Fresno development covering 240,728 acres.

SAN JOSÉ, the capital of Costa Rica, situated in the central tableland of the republic, 3,868 ft. above sea level. This modern city, with well-paved streets and electric lights, is on the transcontinental railway, which connects the capital with the Atlantic and Pacific seaports. Most of the houses are built low as a precaution against earth tremors. The most pretentious building is the National Theater, copied from a Paris structure. There are five public parks, government buildings, a library, a cathedral, several hospitals, and a museum. The climate is healthful. Education is given in law, medicine and allied branches, although the city has no university, and the government offers scholarships in art and music. The coffee trade is the chief activity. Manufacturing is not carried on extensively, but there are enough industries to supply many local needs.

San José was founded in 1738, but has been the capital only since the declaration of independence, 1823, when the administration was moved from the neighboring city of Cartago. The change was made because Cartago was in dangerous proximity to the volcano of Irazu, and had been nearly ruined by an eruption. Est. pop. 1930, 65,963.

SAN JOSE, a city of west central California, and the county seat of Santa Clara Co., situated about 50 mi. southeast of San Francisco. The city is served by the Southern Pacific and a branch of the Western Pacific railways, bus and truck lines and an airport. Located in Santa Clara Valley, called the "valley of heart's delight," San Jose is famous as a health resort and also for fruits, especially prunes. The manufactures include canned and preserved fruits and vegetables. In 1929 the factory output reached approximately \$57,000,000; the retail trade amounted to \$45,764,516. The Lick Observatory on Mt. Hamilton is 26 mi. east of the city. San Jose is the seat of two denominational colleges and the state normal school. San Jose was founded under Spanish authority, in 1777. The American flag was raised in 1846 and in 1850 the city became incorporated. When California became a state San Jose was the first capital. Pop. 1920, 39,642; 1930, 57,651.

SAN JOSE, the 14th Franciscan mission in California, was founded June 11, 1797, by Father Lausen, approximately 15 miles north of Santa Clara in Alameda co. The Indians in the vicinity belonged to the COSTANOAN linguistic stock but the mission also drew neophytes from the San Joaquin and Sacramento valleys who included representatives of the Moquelumnan, Copehan and MARIPOSAN stocks. The greatest number of Indians attached to the mission at any one time was 1,886, the number recorded in 1831. Up to 1834 a total of 6,670 had been baptized of which 2,488 were children. San Jose had more trouble with the Indians than any of the California missions but was materially prosperous. When secularized in 1836 the inventory showed a total valuation of \$155,000 exclusive of lands and church property.

SAN JOSE SCALE, a scale insect of the family *Coccidae*, introduced into California about 1880, prob-

ably from China and sometimes called pernicious scale. Because of the wide variety of woody plants which it attacks, it is one of the most serious insect pests. It may be distinguished from other scale insects by the form of the scale. The females are circular and flat; the male scales are smaller and somewhat elongate, and are black when young but gray or brownish when mature, except for a central yellow of orange spot. Adult males are minute two-winged insects. The young are born alive and enormous numbers may be produced by one female scale. Newly born nymphs move about for a time before settling to feed. They winter as partly grown young, protected by black scales. Several generations occur annually. Standard treatments for this scale are winter-strength lime-sulphur solution and miscible oils.

SAN JUAN, a pueblo and tribe of the North American Indians, speaking the Tewa dialect of the Tanoan linguistic stock. San Juan is situated on the east bank of the Rio Grande, about 25 miles north of Santa Fe, N.M.

SAN JUAN, the chief port and capital of Porto Rico, situated on an island on the northeastern coast and connected with the mainland by bridges. The city was founded by Ponce de Leon in 1520 and named San Juan Bautista de Puerto Rico. It is the only fortified city in Porto Rico. The two magnificent castles, El Morro completed in 1584, and San Cristobal, begun in the early 17th century and completed in 1771, stand as inspiring monuments to Spanish engineering. Among the fine old buildings are the Cathedral, Executive Mansion, and the Casa Blanca. The Post-Office, Customs House, Carnegie Library, Capitol and School of Tropical Medicine are some of the more recent handsome buildings. Tobacco manufacture and the handling of fruits, coffee and sugar for shipping are the chief industries. Bus lines and tramways serve the city's traffic. The spacious harbor, landlocked except on the north, has been deepened with the cooperation of the Federal Government. Pop. 1920, 71,443; 1930, 114,715.

SAN JUAN BAUTISTA. See CALIFORNIA MISSIONS.

SAN JUAN BOUNDARY CONTROVERSY, a dispute between the United States and Great Britain, over an ambiguity in the OREGON BOUNDARY TREATY, which defined the boundary as the 49 parallel to the "middle of the channel which separates the continent from Vancouver Island," and thence southerly through the middle of that channel and the Strait of Juan de Fuca to the Pacific. Great Britain later contended that the channel in question was Rosario Strait, between the San Juan group of islands in Washington Sound and the mainland. The American contention was that the Canal de Haro, between the San Juan Islands and Vancouver Island, was the one intended. The possession of Washington Sound hinged upon the controversy. After 1859 the two governments jointly and amicably occupied San Juan Island, until in 1871 the Treaty of Washington submitted the dispute for arbitration to the Emperor of

Germany. In 1872 the Emperor decided for the United States.

SAN JUAN HILL, BATTLE OF, July 1, 1898, a battle in the SPANISH-AMERICAN WAR which proved to be a costly victory of the American army. Gen. William R. Shafter disembarked his army of 17,000 troops, mostly regulars, at Daiquiri on the southern coast of Cuba, with the intention of moving against Santiago (see SANTIAGO DE CUBA, BATTLE OF) to co-operate with the fleet which had blockaded the port. Advancing against obstinate resistance through a densely wooded country, and suffering from poor rations and inadequate equipment, the army reached San Juan Hill, a strongly fortified strategic point on the direct road to Santiago four miles distant. A simultaneous attack on the neighboring eminence of El Caney (see EL CANEY, BATTLE OF), also strongly fortified, was decided upon. Gen. Wheeler, commanding at San Juan Hill, withheld the opening order until the fire at El Caney was heard; thereupon the army advanced along an exceedingly narrow road, raked by the Spanish cannon. The assault was ultimately successful, the Spaniards retreating to a second line of trenches 700 yards in the rear and continuing to fire until noon, July 3. The American casualties numbered 1,131.

SANKEY, IRA DAVID (1840-1908), American singer and hymn writer, was born at Edinburg, Lawrence Co., Pa., Aug. 28, 1840. He was the author of *The Ninety and Nine* and other gospel songs which were sung at revival meetings held by him and DWIGHT LYMAN MOODY. Sankey died at Brooklyn, N.Y., Aug. 13, 1908.

SANKEY-RITTER METHOD, a method of calculating the stresses in the members of BRIDGE and roof structures. In applying this method the structure is graphically separated into sections and forces are conceived as being attached to the severed members to hold the sections in equilibrium. The magnitude and the direction of these forces, which represent the actual stresses in the severed members, are determined by the law of static moments, $\Sigma M = 0$, with the point of intersection of two of the unknown forces as the center of moments. Also the static laws of vertical and horizontal forces $\Sigma V = 0$ and $\Sigma H = 0$ are utilized.

SANKT PÖLTEN, a city in Lower Austria, near Vienna; the seat of a bishopric. The cathedral, founded in 1060, was rebuilt in 1266 and remodeled in the Baroque style in the 18th century. There is an episcopal palace with a theological seminary and a Franciscan monastery, and there are secular educational institutions. The industrial assets of the city include a number of machine factories and other enterprises. Pop. 1923, 31,576.

SAN LEANDRO, a city in Alameda Co., western California, situated 8 mi. southeast of Oakland on San Francisco Bay, served by the Southern Pacific and Western Pacific railroads. There is an airport. The city is a busy industrial center, manufacturing caterpillar tractors, hay presses, pistons, pickles, and evapo-

rated and canned fruits. The retail trade in 1929 amounted to \$3,209,226. Flowers and fruit are grown in the vicinity. San Leandro, founded in 1836, was incorporated in 1874. The largest flower show in the west takes place in the city, and a cherry festival is held annually. Pop. 1920, 5,703; 1930, 11,455.

SAN LUIS OBISPO, a city in southwestern California, county seat of San Luis Obispo Co., situated on San Luis Obispo Creek, eight mi. from the Pacific Ocean, 240 mi. southeast of San Francisco, served by the Southern Pacific Railroad. There is a privately owned airport. Grain, beans, artichokes, peas and lettuce are the chief crops of the countryside. There are oil fields in the vicinity. The harbor, Port San Luis, nine mi. south of the city, is a shipping point for oil. Father Junipero Serra built his fifth mission here in 1772, now used as the parish church. San Luis Obispo was incorporated in 1870. It is the seat of the California Polytechnic School for Boys. There are sulphur springs in the vicinity. Pop. 1920, 5,895; 1930, 8,276.

SAN LUIS OBISPO, the 5th Franciscan mission in California, was founded by Father Serra, Sept. 1, 1772 on a site now included in the city of the same name. The Indians attached to the mission belonged almost without exception to the CHUMASHAN linguistic stock. The greatest number of neophytes at any one time was 946, reached in 1794. Up to 1834 a total of 2,608 Indians had been baptized of which 1,331 were children. The mission was never particularly prosperous being handicapped by lack of water and hostile Indians. All the horses were stolen in 1840 and the decline thereafter was so rapid that in 1845 the mission was sold for \$510.

SAN LUIS POTOSÍ, a state of Mexico, situated on the great central plateau, with an area of 24,004 sq. mi., and a mean elevation of about 6,000 ft. The Sierra Madre Mountains traverse the state, but drop more than 1,000 ft. towards the southeast to a wide valley which is the most fertile part of the state. The two important rivers are the Panuco and the Rio Verde. Under irrigation the state produces cotton, sugar cane, and some grains and fruit, but it is pre-eminently a mining state. Some of the mines are the richest in the country, and have been worked since before the time of the conquest, but show no signs of decrease in the fabulous deposits of gold, silver, lead and copper ores. The Catorce mine is the most noted of these. Salt deposits of great commercial value are also found in San Luis Potosi, El Penon Blanco being the most important of these. San Luis Potosí is the capital of the state, and other towns are Matehuala, Catorce, Santa Maria, Charcas, Venado and Rio Verde. Pop. 1921, 445,681; 1930, 559,106.

SAN LUIS POTOSÍ, a city of Mexico, capital of the state of the same name, situated near the head of the valley of the Rio Verde, at an altitude of 6,121 ft. above sea level, 139 mi. northeast of Aguascalientes. Mining is its chief industry and the city is a distributing center for mining equipment for the rich silver and copper mines throughout the region. It is also a

avored week-end resort for employees living in the small towns nearby. The city has large wholesale and distributing houses, a smelter, woolen and tanning mills, breweries and foundries and clothing factories. The governor's palace is imposing with a façade of native rose-colored stone. Besides the cathedral, there are the churches Nuestra Señora del Carmen and San Francisco. San Luis Potosí has schools of medicine, law and science. Hand-made lace, drawn-work on linen, pottery and many kinds of curios are sold here. The city was founded as a Franciscan mission in 1586, and is the seat of a bishop. Pop. 1921, 57,353; 1930, 91,126.

SAN MARCOS, a city in southern Texas, the county seat of Hays Co. It is situated on the San Marcos and Blanco rivers, 52 mi. northeast of San Antonio and is served by bus lines and two railroads. There is an airport. Cotton- and grain-growing and cattle-ranching are the leading interests of the countryside. The chief local manufactures are cotton, cottonseed oil and dairy products. The locality is especially noted for its large production of cottonseed for planting purposes. San Marcos was founded in 1835 and incorporated in 1883. It is the seat of Southwest Texas State Teachers' College, and a United States fish hatchery. Pop. 1920, 4,527; 1930, 5,134.

SAN MARINO, a small republic in the north-eastern part of Italy, near the Adriatic. With an area of only 38 sq. mi., it is one of the smallest states in the world and claims to be the oldest existing republic.

Although an independent republic, the Italian influence is strong in San Marino. In 1907 treaty relations with the Italian government were entered into, which were revised in 1908 and 1914. The government consists of a Grand Council of 60 members, one-third of whom are elected every two years. Two members of the council are chosen every six months to act as regents, these being the executives of the republic.

Legend has it that the republic was founded during the 4th century by St. Marinus of Dalmatia. During the medieval struggle between the Guelphs and Ghibellines San Marino sided with the latter. From 1247 to 1249 it was under an interdict by the pope. Seized by Caesar Borgia in 1503, its independence was again recognized by the Pope in 1631. In 1921 San Marino became a haven for Socialists who were opposed by the Fascists. The chief exports of the republic are wine, cattle, and building stone quarried on Mt. Titano. San Marino has no public debt. A part of the revenue is derived from the issue and sale of San Marino postage stamps. The capital city is San Marino. Pop. 1928, 13,013.

SAN MARTIN, JOSÉ DE (1771 or 1778-1850), Argentine soldier and South American "Liberator," born at Yapeyu, a former Jesuit mission on the Uruguay River, Feb. 25, 1771 or 1778. His father was administrator of the mission. He received his earliest instruction at Yapeyu, but later went with his parents to Spain where he entered a school for noble children

in Madrid. Two years later, in 1789, he joined the Murcia regiment as a cadet. His active military career was begun in the Moorish wars in Africa and he served in several campaigns against Napoleon. He came under the influence of many of the most distinguished Spanish officers of his day. For his brilliant action in the battle of Baylen he was appointed lieutenant colonel of cavalry.

In 1811, after the revolution in Buenos Aires had broken out, he left Spain for London, where he met Francisco de Miranda and many others identified with the cause of Spanish American independence. In 1812 he was put, at his request, at the head of a cavalry unit. In 1814 he was put in command of the revolutionary army to fight the royalists in Upper Peru but he soon saw that the Spaniard would have to be defeated first in Chile and Peru. On the pretext of illness he resigned and requested the governorship of the province of Cuyo near the Andes.

At Cuyo San Martin devoted two years to the preparation of an army. In Jan. 1817, he led his troops, under the most trying conditions, over the lofty passes of the Andes. In 1817 and 1818, in the battles of Chacabuco and Maipu, he was successful in freeing Chile. O'Higgins accepted the presidency or office of supreme director, which San Martin refused because he wished to push on to Peru. In July 1821 he occupied the city of Lima, proclaimed the independence of Peru and began, as "Protector," to govern the country. In 1822 SIMON BOLIVAR, having freed Venezuela and Colombia, arrived in Ecuador. San Martin resigned and left the field to Bolivar. He was unwilling to trammel Bolivar's movements. In 1824 he expatriated himself voluntarily from Argentina and spent the remainder of his life in Belgium and France. An unselfish patriot, he died in Boulogne in 1850, a martyr to his own ideals. P. V. S.

SAN MATEO, a city in San Mateo Co., western California, situated on San Francisco Bay, 19½ mi. south of San Francisco; it is served by the Southern Pacific Railroad, a bus line and a street railway. San Mateo is the western terminus of the San Francisco Bay Bridge, having a length of 7.1 mi. There is a commercial airport. The city is a residential community. In 1929 the retail trade amounted to \$7,867,425. Dairying and flower-growing are the leading interests of the countryside. Pop. 1920, 5,979; 1930, 13,444.

SAN MIGUEL, city of Salvador, the capital of the department of the same name, near the Rio Grande, and about 9 mi. below the active volcano of San Miguel, about 75 mi. southeast of San Salvador. Formerly an overgrown rural settlement depending entirely on the agricultural resources of the district, San Miguel is now a city with a railway, fine municipal buildings, a number of attractive churches and two modern hospitals. Founded in 1530 by Spanish settlers, in 1586 it became a city. Pop. 1930, 40,349 with suburbs.

SAN MIGUEL, the 16th Franciscan mission established in California, July 25, 1797, in the upper

Salinas Valley in the northern part of the present San Luis Obispo county. The Indians of this mission belonged chiefly to the SALINAN linguistic stock though probably included also many Yokuts from the San Joaquin Valley. The greatest number of Indians attached to the mission at one time was 1,076, reached in 1814. Up to 1834 a total of 2,562 natives had been baptized of which 1,277 were children. The mission was sold in 1845. In 1931 the church building was still in use.

SAN RAFAEL, a residential and commercial city in western California, county seat of Marin Co., situated near San Pablo Straits, 15 mi. north of San Francisco. It is served by buses, ferries and the Northwestern Pacific Railroad. The countryside has dairies and poultry farms. There is a glove factory in this city. San Rafael is the seat of several private schools and a Dominican college for girls. A Franciscan mission was established here in 1817, but has been completely demolished except for a mission bell guide post. Pop. 1920, 5,512; 1930, 8,022.

SAN REMO, a port and resort city in the province of Imperia, Liguria, northwestern Italy, situated on the Mediterranean, about 20 mi. from the French border. The old town is perched at the top of a hill; the new town lies below. In the old town are a handsome domed church and a Romanesque cathedral. A mole protects the harbor. Palm trees flourish here, and olives, lemons, and roses are commercial products. San Remo is a well-known winter resort. Pop. 1931, 31,607.

SAN SALVADOR, or Watlings Island, one of the 20 inhabited and uninhabited rocks and islands of the West Indies lying off the southeastern coast of Florida and known as the British Bahamas. San Salvador is called by the natives Guanahani and is believed to be the first body of land seen by COLUMBUS upon his discovery of the New World. This island is one of the less important of the Bahamas. Pop. 1931, 675.

SAN SALVADOR, the capital of the republic of Salvador and of the department of San Salvador, located in a fertile valley on the River Asaguate, the cone of the volcano of Salvador rising distinctly above it. This is probably the most modern of Central American cities. It is set in a beautiful circlet of hills and volcanic cones of many sizes. There are many handsome buildings. The large reinforced concrete National Palace covers a whole city block and its imposing architecture has already proved its strength in withstanding earthquakes. The streets are well-paved and are traversed by modern motor buses. There are a dozen metropolitan city squares with fine monuments and churches; two parks and a botanical garden; a university; a cathedral; an academy of literature and science and an astronomical observatory. The production of soap, shawls, candles, silk scarfs, spirits, flour and cigars are important industries.

The city was originally founded about 1528 by Don Jorge de Alvarado, brother of the conqueror of Guate-

mala, some distance from its present position, under the shadow of the restless volcano. A more dangerous site could scarcely have been selected, yet, although the place was twice destroyed by earthquakes in the 19th century, its inhabitants have always returned. Pop. 1930, 96,447 with suburbs.

SANS ARC, one of the bands of the Teton division of the DAKOTA, a tribe of the North American Indians, speaking a dialect of the Siouan linguistic stock.

SANS CULOTTES, a name given generally to the Republicans at the time of the French Revolution because of their clothing. The name meant without knee breeches, a garment worn by the aristocracy of the period while the working classes wore the modern long trousers.

SAN SEBASTIÁN, a city of Spain, capital of the province of Guipuzcoa. It is situated on a tongue of land in the Bay of Biscay almost on the French frontier. San Sebastián was a former summer residence of the king. Since its destruction in 1813 it has been rebuilt with spacious streets and a square with fine buildings, arcades and a monumental fountain. The city is the seat of the captain-general of the Basque provinces, of a governor and a bishop. It has the Church of St. Mary in Baroque style, 1743-64, a Gothic church, a citadel, a former royal villa, a casino and bull ring. San Sebastián has manufactures of anchors, wall-paper, sailcloth, glass and chemicals. Est. pop. 1929, 78,013.

SANSKRIT LANGUAGE, the most important member of the INDO-IRANIAN group of the INDO-EUROPEAN linguistic family, and the classical language of ancient India.

Spoken as a vernacular from at least 1500 B.C. to perhaps 800 A.D., it survived as a vehicle of literature as late as the 16th century, and is spoken and written to some extent by native scholars in India. It ranks with GREEK and LITHUANIAN in importance for the scientific investigation of Indo-European because of its retention, particularly in the Vedic period, of primitive forms, especially in consonantism and morphology.

The lack of exact historical data in India renders it impossible to define more than roughly approximate periods in the evolution of the language, but the main outlines of its development are fairly clear. The earliest form, found in the Vedas (?1500-1000 B.C.), is characterized by a multiplicity of grammatical forms richer even than Greek; then come the Brahmanic and Epic periods (?1000 B.C.-320 A.D.), in which the language becomes increasingly simplified; and, finally, the classical period, which alone is technically termed Sanskrit (320-800). From about the 3rd century B.C., it had an increasingly powerful rival in PRAKRIT, which eventually supplanted it as a vernacular and ultimately developed into MODERN INDIAN.

The principal characteristics of Vedic, scientifically by far the most important form, are change of Indo-European *e* and *o* to *a*, retention of noun-declension

to a degree paralleled in Indo-European only by Lithuanian (these two phenomena in classical Sanskrit as well), and a verb-system superior even to Greek (greatly simplified in classical Sanskrit). It must be noted, however, that classical Sanskrit is not developed directly from Vedic, but from a type closely akin to it; it is, in reality, a Prakrit which attained literary supremacy and systematization. L. H. G.

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SANSKRIT LITERATURE, the classical literature of India, extending from at least 1500 B.C. to the present day. It is conveniently divided into five periods: Vedic (?1500-1000 B.C.), Brahmanic (1000-500 B.C.), Epic (500 B.C.-320 A.D.), Classical (320-800) and Post-Classical (800 onward).

Vedic Period. This is at once the most interesting and the most important of the above divisions. Its literary records are the four *Vedas*, or "Knowledges": *Rig* ("Chant"), *Sāma* ("Song"), *Yajur* ("Sacrifice") and *Atharva* (so named from a division of priests). The *Rig-Veda* consists of somewhat over a thousand hymns, often very composite in their present form, and composed by a large number of poets during a period which can be delimited only approximately. Almost all are devoted to the laudation of one or more divinities, and range in quality from outbursts of true poetic beauty to mere mechanical compositions. Some of them contain at least the elements of dramatic dialogue, and others are intended to be magic in potency. It is possible to gain from them valuable data regarding the civilization of early India during the period of invasion of the peninsula through the Panjab; the life which they portray is that of a brave and manly people whose very shortcomings are those of sturdy and respectable barbarians.

The *Sāma-Veda* is composed almost solely of extracts from the *Rig*. The *Yajur-Veda*, on the other hand, in a number of recensions, possesses independent worth as giving details of the highly complicated system of sacrifice which had already been developed. The *Atharva-Veda*, though not regarded in India as canonical, possesses a peculiar interest as the "Knowledge" of magic, thus giving the popular religion of its day as distinct from the official religion of the other Vedas. Later in date than any of the rest, it yet doubtless contains much material older even than the *Rig-Veda*.

Brahmanic Period. This was the age of learned commentaries on the Vedas, with further elucidation of the sacrifice, of the formulation of rules for conduct in every sphere, of the beginnings of studies in grammar and metrics, and of the creation of a distinct type of philosophy. The commentaries on the Vedas, called *Brāhmanas*, consist of three parts: the *Brāhmaṇa* proper, the "Forest-Book" (*Āraṇyaka*) and the "Session" (*Upanishad*). The first, devoted to the minutest sacrificial details, interpreted most symbolically, is yet interspersed with legends of interest; the

second was for the use of those who had renounced the world and retired to the forests for meditation; and the third indelibly stamped upon India its peculiar type of philosophic outlook. The Upanishads apparently represent the thoughts of many centuries indiscriminately jumbled together, so that no single system can be formulated from them; but their essential underlying motive is a purely egoistic endeavor to attain release (*mokṣha*) from life's reincarnations, which are inherently evil, by means of saving knowledge. The remaining themes of this period are of less general interest.

Epic Period. This period is marked in poetry by the two great epics of the *Mahābhārata* and *Rāmāyana*, the former some eight times longer than the *Iliad* and *Odyssey*, and a composite poem containing, among other episodes, the much over-valued *Bhagavadgītā* on philosophy. Here also belong the collection of fables called the *Panchatantra*, or "Five Threads," inspired probably by the *Jātakas*, or tales of the former births of the Buddha, and its abridgement, the *Hitopadeśa*, or "Good Counsel." These centuries likewise saw the beginnings of artificial poetry, the formulation of the six systems of orthodox philosophy ("orthodoxy" here meaning only acknowledgement, however formal, of the authority of the Vedas), the development of the theory of grammar, reaching its climax in the marvelous treatise of Pāṇini, codifications of law, of which the most authoritative was the *Code of Manu*, and treatises on rhetoric, dramaturgy, music, medicine and even erotics.

Classical Period. This period is especially rich in drama, the most famous name being that of Kālidāsa, whose *Çakuntalā* inspired GOETHE to sentimental enthusiasm, and who also wrote, among other works, the charming *Meghadūta*, or "Cloud-Messenger." Besides much art-poetry, there was a wealth of quatrains in various meters, especially those of Bhartṛihari, to whom are ascribed three "centuries" on conduct, love and renunciation respectively, of which the first and last were the earliest of all Sanskrit works to be translated into an Occidental language by Roger, the Dutch missionary. Highly artificial romance, with matter utterly subordinated to style, was created during this period, as in the *Vāsavadattā* of Subandhu; and the picaresque romance found its Indian representative in Dandin's *Daçakūmarācharita*, or "Adventures of the Ten Princes": while Varāhamihira wrote the chief contribution to astronomy in his *Bṛhatsamhitā*.

Post-Classical Period. Sanskrit had now ceased to be generally spoken, but continued to survive as a learned language. To this period belong, among countless others, the dramatist Rājasekhara, Somadeva's versified folk-tales collected in his *Kathāsaritsāgara* ("Ocean of Story-Stream"), Kṛṣṇamīra's allegorical drama *Prabodhachandrodaya* ("Rise of the Moon of Intellect"), Jayadeva's lyric *Gītagovinda*, telling of Krishna's love for Rādhā, and the one native Sanskrit production in formal history, the *Rājataranginī* of the Kashmirian Kalhana. For the most part,

however, the output had now become little more than reworking of old themes, artificiality of manner increasingly replacing originality of thought.

L. H. G.

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SANSOVINO, JACOPO (1486-1570), Italian architect and sculptor, was born at Florence in 1486, his original name of Tatti being changed in honor of his teacher, Andrea Sansovino. He studied and worked in Rome and Florence, devoting himself particularly to sculpture. After 1527 Sansovino resided in Venice and worked chiefly in architecture, designing the Palazzo Corner, 1532, the Library of St. Mark, 1536, the Mint, and the churches of St. Martin, San Martino, San Guliano, San Giorgio dei Greci, and parts of the churches of San Fatino and Santa Maria Mater Domini. His works of sculpture in this period included the Madonna of the Arsenal, 1530, and the giant statues of Mars and Neptune on the steps of the palace of the Doges. Sansovino's early training as a sculptor affected his architectural designs which always provided a maximum of sculptural ornamentation, sometimes to an extravagant degree. He died at Venice, Nov. 27, 1570.

SAN STEFANO, a suburb of Istanbul or Constantinople, Turkey, on the railway from Edirne. The town is chiefly known for the peace treaty signed in 1878 between Russia and Turkey. See SAN STEFANO, TREATY OF.

SAN STEFANO, TREATY OF, a compact which concluded the Russo-Turkish War and was signed by Russia and Turkey, Mar. 3, 1878, at San Stefano on the Sea of Marmora. By its provisions Turkish possessions and power were greatly reduced and Russian power, real and potential, considerably augmented. It created a larger Bulgaria extending from the Danube to the Aegean, recognized the independence of Serbia, Rumania and Montenegro and awarded to Russia a huge war indemnity and a large extent of territory south of the Caucasus in Asiatic Turkey. The treaty aroused much concern and disapproval. Great Britain strongly opposed it because it increased Russia's power and Austria because it threatened her Balkan interests, while several of the ceded provinces protested. The CONGRESS OF BERLIN, which met the following June 13, greatly altered its provisions.

SANTA ANA, a pueblo and tribe of the American Indian Keresan linguistic stock. The pueblo is situated on the western bank of the Rio Jemez, a branch of the Rio Grande, in central New Mexico. At the time of the Spanish explorations, the tribe occupied a pueblo on the great Black mesa of San Felipe. This village was destroyed during the Pueblo Revolt in 1687 and the present village built after 1692. It is known to the natives as Tamaya, as were their two previous pueblos.

SANTA ANA, the capital of the department of the same name in the republic of Salvador, about

30 mi. northwest of San Salvador, about 2,100 ft. above sea level. The second city in size in the republic, it is the chief agricultural center, occupying an important position on the main highway between Guatemala and San Salvador. There are many coffee and sugar plantations. The neighboring district is rich in minerals. Since the opening of the railway there has been a great increase in commerce. Cigars, textiles, pottery, spirits, starch and sugar are manufactured. The climate is hot and dusty, but the lakes of Salvador offer respite from the wet summer heat of the town. Santa Ana is a picturesque place with a wide plaza full of flowers and handsome old colonnades that earthquakes have spared. Pop. 1930, 75,860 with suburbs.

SANTA ANA, a city in southern California, county seat of Orange Co., situated 30 mi. southeast of Los Angeles, served by buses, three railroads and the Pacific Electric Railway. There is an airport. Highly productive oil fields lie in the vicinity. The fertile Santa Ana Valley produces fruit, vegetables, oranges, walnuts and sugar-beets, and also bees and livestock. There are commercial fisheries near by. The city has beet-sugar, fruit canning and glass factories. The total output for 1929 was valued at \$5,099,756. In 1929 the retail business amounted to \$24,360,416. Santa Ana was laid out in 1869 and incorporated in 1870. The city is half way between the Pacific Ocean and the Santa Ana Mountains. Pop. 1920, 15,485; 1930, 30,322.

SANTA ANNA, ANTONIO LOPEZ DE (1795-1876), Mexican soldier and President, was born at Jalapa, Vera Cruz, on Feb. 21, 1795. Joining the Spanish colonial army in 1810, he became a brigadier and in 1821 governor of the Vera Cruz Department. He supported AUGUSTIN DE ITURBIDE at first, but later led a revolt against him. Santa Anna subsequently became governor of Yucatan, but returned to Vera Cruz as governor in 1827. Two years later he led the forces which repulsed the Spanish attempt to regain Mexico. Elected president in 1833, he held office until defeated by the Texans at San Jacinto in 1836. He led the Mexican troops against the French invaders at Vera Cruz in 1838, and by way of a revolution became President and Dictator in 1841. Expelled in 1845, he was recalled in the following year to command the army in the Mexican War. Chosen President by Congress, he retired after the capture of Mexico City. He managed to attain the dictatorship for the last time in 1853, but was exiled from Mexico two years later. He died at Mexico City on June 20, 1876.

SANTA BARBARA, a seaside resort on the Pacific Ocean in southern California, the county seat of Santa Barbara Co., situated 100 mi. northwest of Los Angeles. Several bus lines and the Southern Pacific Railroad serve the city. There are several airports. The region has large lemon and walnut crops, and half the lima bean output of the United States. In 1929 the local factory output was valued approximately at \$2,000,000; the retail trade amounted

to \$32,363,468. Santa Barbara is the seat of a teachers' college, opened in 1909, and St. Anthony's seminary and Santa Barbara Mission founded by Father Fermin de Lasuen in 1786, now the headquarters of the Franciscans on the Pacific coast. As early as 1603 Sebastian Vizcaino, the explorer, gave Santa Barbara its name, and in 1782 a Spanish garrison was established here. The Americans finally took permanent possession in Oct. 1846. The city was incorporated in 1850, but it was not until 1870 that Spanish ceased to be the language of the city council. In 1925 serious damage was done by earthquake. The surroundings of this city bordering a crescent-formed beach and rising on the slopes of Santa Ynez Mountains are especially beautiful. Nearby are sulphur springs and the Painted Cave, the walls of which were probably decorated by prehistoric artists. Pop. 1920, 9,441; 1930, 33,613.

SANTA BARBARA, the 10th Franciscan mission founded in 1786 in what is now the city of Santa Barbara, Calif. The Indians assembled at the mission during its history were chiefly of the CHUMASHAN linguistic stock and, according to mission archives, contained representatives of about 58 villages. That the Yokuts were also represented is attested by the fact that many neophytes were said to have come from "Tulares." The greatest number of Indians attached to the mission at any one time was 1,792, reached in 1803. Up to 1834 a total of 4,658 native baptisms had been made. The mission was sold in 1846, though the principal buildings remained in the possession of the Church.

SANTA BARBARA ISLANDS, a group of 8 islands: San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Barbara, SANTA CATALINA, San Clemente and San Nicholas, lying off the coast of southern California opposite Santa Barbara, Ventura, Los Angeles and San Diego counties. They extend in a northwest to southeast direction for approximately 160 mi. and are from 20 to 60 mi. from the mainland.

SANTA CATALINA, one of the SANTA BARBARA ISLANDS, situated about 20 mi. off the coast of southern California and separated from the mainland by San Pedro Channel. The island is approximately 25 mi. long and has an average width of 4 mi. Juan Rodriguez Cabrillo, a Portuguese explorer in the service of Spain, discovered the island in 1542 and named it San Salvador. Sixty years later the island was given its present name by Sebastian Vizcaino, a Spanish navigator, in honor of Saint Catharine of Sienna. The surface of the island is mountainous and on a clear day a splendid view of the adjacent coast of California rewards a climb to one of the summits. The flora is particularly interesting, some of the plants being peculiar to the island. The waters around Catalina are a famous deep sea fishing grounds. Especially prized are the tuna, yellow-tail and the giant jewfish; flying fish are numerous in the channel. The only town on the island is AVALON.

SANTA CLARA, a pueblo and North American Indian tribe of the Tanoan linguistic stock, situated

on the west side of the Rio Grande, about 30 miles north of Santa Fe, N.M.

SANTA CLARA, a town in Santa Clara Co., western California, nine mi. south of San Francisco Bay and three mi. from San Jose. It is served by buses, airplanes and the Southern Pacific Railroad. The prune crop of Santa Clara Co., 1930, was valued at \$9,808,750. Other fruits and nuts and olives are raised in the vicinity. The town has lumber mills, fruit canneries and packing houses. There are manganese, magnesite, oil and quicksilver deposits in the neighborhood. The town is the seat of the University of Santa Clara, a Catholic institution founded in 1851. Father Junipero Serra established the Mission of Santa Clara de Asis in 1777. The first permanent settlement was made in 1780; the town was incorporated in 1852. Lick Observatory, built on Mt. Hamilton, is 26 mi. east. California State Redwood Park lies to the southwest. Pop. 1920, 5,220; 1930, 6,302.

SANTA CLARA, the eighth Franciscan mission in California, was founded Jan. 12, 1777, close to the head of San Francisco Bay and about 3 miles from its present position in the town of Santa Clara. The Indians in the neighborhood belonged to the COSTANOAN linguistic stock and the majority of the neophytes connected with the mission were undoubtedly of this stock though it is highly probable that the Yokuts and Moquelumnan stocks were also represented. The greatest number of Indians attached to the mission at any one time was 1,464, reached in 1820. Up to 1834 a total of 7,711 baptisms had been made of which 3,177 were children. During much of its history the mission had difficulty with theft and desertion on the part of the Indians. It is now included in Santa Clara University.

SANTA CLARA, UNIVERSITY OF, a Catholic institution for men at Santa Clara, Cal., was founded in 1851 on the site of the old Santa Clara Mission. Although chartered as a university in 1875, the institution continued as Santa Clara College until 1912, when the title of university was assumed. The institution includes colleges of Philosophy and Letters, General Science and Engineering, the Institute of Law, the School of Pedagogy and the Pre-Medical Course. It had productive funds in 1931 amounting to \$400,000. The library contained 59,000 volumes. In 1931-32 there were 476 students and a faculty of 46, headed by Pres. CORNELIUS J. MCCOY.

SANTA CLAUS, a Dutch corruption of St. Nicholas, the patron saint of children, who is supposed to have been Bishop of Myra at about 350. The Eve of St. Nicholas, formerly celebrated on Dec. 6, has gradually shifted to Christmas Eve.

SANTA CRUZ, ANDRES (1792-1865), Bolivian President, born Nov. 30, 1792 in the province La Paz. He participated in the Peruvian war of independence and in 1824 was appointed by Bolivar chief of staff. After the war he was sent to Chile on a brief mission and in 1826 acted as provisional President of Peru during the absence of Bolivar. In 1829 he returned to Bolivia and succeeded Sucre as president of that

country. His influence was significant in the formative period of Bolivia's national life. He organized the army and the national guard, established universities, promulgated legal codes, and gave the country two constitutions. In 1831 the national assembly gave him the title of *Gran Ciudadano* and *Restaurado de la Patria*, great citizen and restorer of the motherland. Invited by the President of Peru to intervene in the civil conflicts of that country, he defeated the opposing factions and set up, in 1836, the Peru-Bolivian Confederation, which had long been a dream of his. Chile, however, broke up the Confederation and it was dissolved in 1839. Santa Cruz went into exile and later served as Bolivian minister successively to Paris, Madrid, Rome, London and Brussels. He died in Nazaire, France, in 1865.

SANTA CRUZ, a seaport city in western California, county seat of Santa Cruz Co., situated on the northern coast of Monterey Bay at the mouth of the San Lorenzo River, 78 mi. south of San Francisco. Bus and truck lines, steamers and the Southern Pacific Railroad afford transportation. There is an airport near by. Fruit, vegetables, especially artichokes and bulbs, and poultry are raised in this region. The chief industries are fruit packing and the manufacture of cement, limestone products, incubators and leather. The industrial output, 1929, amounted to \$1,440,431. In 1929 the retail business reached a total of \$9,986,386. Santa Cruz has commercial fisheries. The shipping of the harbor, 1929, weighed 3,248 tons, worth \$330,821. The State Redwood Park is 23 mi. north and the Santa Cruz Co. Big Trees are six mi. distant. A mission was established at Santa Cruz in 1791. The Americans took possession in 1846, and the city was chartered in 1876. Pop. 1920, 10,917; 1930, 14,395.

SANTA CRUZ, the twelfth Franciscan mission in California, was founded Sept. 25, 1791, within the limits of the present city of the same name in Santa Clara co. The Indians in the vicinity belonged to the COSTANOAN linguistic stock and, according to mission records, neophytes included representatives from 36 villages. The greatest number attached to the mission at any one time was 523, reached in 1796. Up to 1834 a total of 2,216 had been baptized. This mission was one of the least successful, there being almost constant friction between the padres and the neophytes who charged the padres with cruelty and between the padres and the authorities at Brancifort.

SANTA CRUZ DE TENERIFE, or DE SANTIAIGO, a Spanish seaport of the Canary Islands, of which it is the capital. It is situated on the east coast of the island of Tenerife and is well-built, containing a number of notable public and private buildings. There is a school for navigation, a museum of natural history, and a number of technical and secondary schools. Santa Cruz is important as a trade and coaling center. The chief exports are sugar, wine, brandy and cattle. Pop. 1928, 56,000.

SANTA FÉ, a city of Argentina, situated near the mouth of the Salado River, about 300 mi. northwest

of Buenos Aires. It has a ferry across the river to PARANÁ, and is a port of call for boats plying the Salado and the Paraná rivers. Its harbor can accommodate 25 sea-going vessels. The city is well built, has a university, a Jesuit college and church, erected in the middle of the 17th century, and other old buildings. It is also the seat of a bishopric, and has several charitable institutions. Santa Fé is an important railroad center. Est. pop. 1930, 140,000.

SANTA FE, the capital city of New Mexico, the county seat of Santa Fe Co. It is situated in the northern part of the state, on the Rio Sante Fe, at the foot of the Sangre de Cristo Range, 66 mi. northeast of Albuquerque. Bus lines, airplanes and two railroads serve the city. Santa Fe is one of the oldest cities in the United States and has been the capital of several governments. Through the efforts of a committee connected with the School of American Research and the State Museum the new buildings blend with the picturesque old Spanish houses and with the remains of the pueblo terraced dwellings. The city is built around a plaza. The governor's palace, built in 1610, was the gubernatorial residence of Spanish, Indian, Mexican and American authorities until 1909, and is now a museum. Other notable buildings are the puddled adobe house, built before the arrival of the Spaniards, San Miguel Church, dating from 1636, the Cathedral, part of which was erected in 1711, and the new state museum. Surrounding the city are interesting scenic points, including several Indian pueblos, Santa Fe National Forest, Puye Cliff dwellings and turquoise mines. Santa Fe is an Arch-Diocese of the Catholic Church.

Santa Fe was built on the site of an Indian settlement, in ruins when the Spaniards came in 1610. The Pueblo Indians drove out the intruders in 1680; the Spaniards reconquered the territory in 1692. In 1846 Santa Fe came under American control. It was chartered as a city in 1891. In 1929 the local manufactures were valued approximately at \$270,000; the retail trade amounted to \$6,011,031. Pop. 1920, 7,236; 1930, 11,176.

SANTA FE, BATTLE OF, Aug. 18, 1846, an engagement of the MEXICAN WAR. The occupation of New Mexico and California being an objective of the Mexican War, Col. S. W. Kearny, stationed at FORT LEAVENWORTH, was ordered, in June 1846 to lead an expedition to Upper California by way of Santa Fe. By the end of July Kearny had concentrated 1,800 troops at Bent's Fort, on the Arkansas; the expedition marched toward Santa Fe along the old Santa Fe trail. An army of 4,000 Mexicans, gathered at the city to oppose him, fled without offering battle. Kearny took possession, organized a provisional government for New Mexico, and, leaving 1,500 troops in Santa Fe resumed his march on Sept. 25.

SANTA MARGHERITA CONVENTIONS, a group of four conventions between Italy and Yugoslavia signed at Rome on Oct. 23, 1922. Ratifications were exchanged at Rome on Feb. 26, 1923, and the

documents were registered with the League of Nations Secretariat on Sept. 12, 1923. The chief convention had for its purpose the carrying out of the Treaty of Rapallo, Nov. 12, 1920, regarding Fiume and Dalmatia. It provided for the immediate evacuation by the Italians of the Third Zone of Occupation in Dalmatia, and the fixing of the boundaries and administration of a Free State of Fiume. The remaining conventions dealt with customs arrangements, frontier traffic, and a general agreement on the future relationship between the adjacent Italian and Yugoslav territories in Dalmatia. The establishment of a Fiume Free State proved impracticable, and on Jan. 27, 1924, a new Italo-Yugoslav treaty was signed at Rome giving the City and Port of Fiume to Italy, while Yugoslavia was allowed to have Port Baross and the Delta, as well as a 50-year lease of some space in the Port of Fiume itself.

SANTA MARIA, a city in Santa Barbara Co. in southwestern California, situated on the Santa Maria River, 181 mi. northwest of Los Angeles and 81 mi. north of Santa Barbara. It is served by the Santa Maria Valley and Pacific Coast railways and bus lines. Farming and dairying are the leading agricultural interests. There are oil-fields in the vicinity. Santa Maria is a trade center and a shipping point for lettuce, and has a sugar-beet factory and concrete works. The city is the seat of the Hancock Foundation College of Aeronautics with a well-equipped airport. Santa Maria was incorporated in 1905. Pop. 1920, 3,943; 1930, 7,057.

SANTA MONICA, a seaside city in Los Angeles Co., southern California, on Santa Monica Bay, 13 mi. west of Los Angeles, served by buses and the Pacific Electric Railway. Clover Field, an airport, is within the city limits. Santa Monica is essentially a residential community, but there are several factories, producing airplanes, tiles, bricks and miners' lamps. The factory output, 1929, was worth \$4,356,656. In 1929 the retail business amounted to \$23,485,354. Santa Monica was founded in 1870, incorporated in 1886 and became a city in 1907. It is beautifully situated on the bluffs overlooking the sea with mountains in the background. Several motion picture stars have palatial residences on the coast. There are numerous recreational facilities, including a fine municipal fishing pier. Pop. 1920, 15,252; 1930, 37,146.

SANTANDER, FRANCISCO DE PAULA (1792-1840), first President of Colombia, or New Granada as known then, was born in Rosario de Cucuta and studied at St. Bartholomew College. At the age of 18 he volunteered, soon came to the notice of Bolivar, and was entrusted with responsible posts. In 1821 he was chosen vice-president of New Granada and governed that part of the Republic of Gran Colombia in the absence of Simon Bolivar, the president. Santander soon came to disagree with the great Liberator, opposing the latter's centralism with a strong feeling for a federal form of government. This was so manifest at the Convention of Ocaña in 1828 that an attempt to assassinate Bolivar was laid

at Santander's door. He left the country but was elected the first president of the Republic of New Granada in 1832, serving until 1837 when he was defeated for reelection. He became unpopular, although he is considered one of Colombia's greatest heroes. Santander died in 1840.

SANTANDER, a city of Spain, capital of the province of the same name, and located on the Bay of Biscay about 50 mi. northwest of Bilbao. It is an industrial city and seaport. The city has a fine quay, pleasant promenades, a Gothic cathedral with a 13th century Romanesque crypt, a citadel, educational institutions and museum. There are also foundries and shipyards, and numerous factories producing paper, tobacco and other commodities. The harbor accommodates ships of great size. The imports are triple the value of the exports. Est. pop. 1929, 84,693.

SANTA PAULA, a city in Ventura Co., southern California, on the Santa Clara River, 50 mi. northwest of Los Angeles, served by the Southern Pacific Railroad. Near by are oil fields. Oil-refining and fruit packing are the city's principal industries. The chief crops are lemons, oranges, beans, apricots and walnuts. Santa Paula is on the edge of Santa Barbara National Forest. Pop. 1920, 3,967; 1930, 7,452.

SANTA ROSA, a city in western California, the county seat of Sonoma Co., situated 52 mi. northwest of San Francisco. It is served by two railroads and by bus and truck lines and an airport. The surrounding country is a fertile valley producing fruit, nuts, grain, vegetables, dairy products and live stock. Santa Rosa is a shipping point for the farming area and has some manufactures, including clothing, shoes and canned and preserved food products. The retail trade in 1929 amounted to \$14,561,480. The Spaniards founded Santa Rosa in 1829; it was incorporated in 1872. On Apr. 18, 1906, the city was badly damaged by earthquake. **LUTHER BURBANK** chose Santa Rosa for his experimental gardens on account of the climate and the fertility of the soil. Pop. 1920, 8,758; 1930, 10,636.

SANTA TECLA or Nueva San Salvador, a city of Salvador, situated about 10 mi. from San Salvador, and connected with it by a branch railroad. It is modern in construction and has an increasing trade in the products of the surrounding country, coffee, sugar and some tropical fruit. Santa Tecla was founded in 1854, to become the capital of the republic instead of San Salvador, which had been destroyed by an earthquake. The capital was, however, rebuilt at once. Pop. 1930, 30,447 with suburbs.

SANTAYANA, GEORGE (1863-), Spanish-American philosopher, was born at Madrid, Dec. 16, 1863. In 1874 Santayana came to America. He graduated from Harvard in 1886 and received his Ph.D. there in 1889. From 1889-1912 he taught philosophy at Harvard, becoming a full professor in 1907. Santayana's first literary efforts were as a poet, his *Sonnets and Poems* appearing in 1894. Among

his well-known works are the following: *The Sense of Beauty*, 1896; *The Life of Reason*, 1905; *Winds of Doctrine*, 1913, and *Scepticism and Animal Faith*, 1923. On leaving Harvard in 1912 he went abroad to live.

From the epistemological standpoint, Santayana is a critical realist and from the metaphysical, a materialist. He contributed an essay to the volume entitled *Critical Realism* in 1922. In this realism the doctrine of the essence is central. As being that which is immediately given, it is both the carrier of knowledge and the seat of value.

SANTA YNEZ, the nineteenth Franciscan mission founded in California, was established Sept. 17, 1804, at a place called Alajulapu by the natives, 25 miles from Santa Barbara. Indians in the neighborhood belonged to the CHUMASHAN linguistic stock to which the majority of the neophytes undoubtedly belonged. A distinct Chumashan dialect known as Santa Ynez was developed at the mission. The greatest number of Indians at any one time was 768, in 1816. Up to 1834 a total of 1,323 baptisms had been made. Materially the mission was prosperous. Some of the Indians became highly skilled in silver and carved leather. After 1844 the decline was rapid and in 1846 the mission was disbanded and the lands sold.

SANTEE, an easterly division of the North American Indian Dakota of the Siouan linguistic stock, comprising, according to the usage of the Missouri River Dakota, the Wahpekute and sometimes also the Sisseton and Wahpeton. Since 1862 the Santee have been settled on the Santee reservation in northern Nebraska. They now number about 1,200, all citizens of the United States, and have largely abandoned their nomadic habits.

SANTEE RIVER, a stream of South Carolina, formed by the union of the Wateree and Congaree rivers at the southeastern extremity of Richland Co. in the center of the state. Its headstreams have their sources in the Blue Ridge Mountains, and the Congaree is a continuation of the Broad and Saluda rivers which unite at Columbia. The general direction of the Santee system is southeast. It crosses the Piedmont region and the Atlantic coastal plain and empties into the Atlantic Ocean near Cape Romain. The drainage area, estimated at 14,696 sq. mi., is devoted to cotton and tobacco-raising.

SANTIAGO, a shortened form of Saint James, the national saint of Spain. He was the son of Zebedee, the brother of John, and is accredited with numerous miracles, particularly with that of having caught his head in his hands when he was beheaded by the Jews. It is recorded that he aided the Spanish kings 38 times in their wars against the Moors. Santiago became a Spanish war-cry.

SANTIAGO, the capital of Chile, in the province of Santiago, situated in the valley of the Mapocho River near the western base of the Andes, about 1,600 ft. above sea level, and 116 mi. directly southeast of Valparaiso. Santiago is the social, political and business heart of Chile. It contains most of the wealth

of the republic. It has grown in beauty and modern improvements and has widened its streets and repaved them with asphalt; the Alameda, on which is located the Union Club, the social headquarters of the city, is a splendid boulevard with a garden through the center and driveways on each side. The Cousiño Park is southwest of the city and a forest park is on the other side skirting both banks of the Mapocho; near the Cousiño Park is the race course, famous for its fine buildings and equipment. Santa Lucía, the table mountain rising straight up from the city, is a scenic spectacle. In addition to the splendid location there are many imposing buildings, including several fine churches and schools. Full religious liberty is granted, and the Protestants have churches, missions and schools, although 94% of the population are Roman Catholics. The Catholic Church owns property in Santiago to the amount of \$100,000,000. It has some of the best business blocks, many stores, thousands of rented houses, many farms and the whole of one side of the Plaza des Armas, the central square.

Breweries, flour mills, knitting mills, foundries and tanneries, are among the principal industrial plants. Santiago was founded by Pedro de Valdivia, Feb. 12, 1541, around the Huelén Hill, or Santa Lucía. It has had several earthquakes and has suffered from political disorders. Pop. of the municipality, 1930, 542,432; of Greater Santiago, 712,533.

SANTIAGO DE CUBA, a port of Cuba, capital of Oriente Province, situated on the eastern shore of the island, about 475 mi. directly southeast of Havana, with which it is connected by rail. It is the second largest city of Cuba, has an excellent harbor and is located in a rich agricultural and mining district. The principal manufactured products are iron, cigars and soap. The chief exports are sugar, rum, cigars, cacao, coffee, iron and copper ores and mahogany woods. Santiago was founded by the Spanish in 1514. During the Spanish-American War it was a principal scene of action. *See* SANTIAGO DE CUBA, BATTLE OF. Beginning Feb. 2 and 3, 1932, earthquake shocks caused damage to the city estimated at between \$1,000,000 and \$2,000,000. Pop. 1928, 48,500.

SANTIAGO DE CUBA, BATTLE OF, July 3, 1898, a naval engagement of the SPANISH-AMERICAN WAR. On May 28 the American fleet under Commodore Schley blockaded the Spanish fleet of six vessels under Admiral Cervera within the harbor of Santiago, Cuba. Admiral Sampson arrived off Santiago three days later, increasing the American squadron to seven vessels. The checkmate was enlivened, June 3, by the daring attempt of Lieut. Hobson and three companions to sink the collier *Merrimac* in the bottle-neck of the harbor, to prevent the possible escape of the Spanish fleet. Within the next few weeks the American army in Cuba, co-operating with the fleet, was successful at El Caney and San Juan Hill (*see* EL CANEY, BATTLE OF; SAN JUAN, BATTLE OF) and was approaching Santiago. On July 3 Cervera's fleet made a forlorn effort to run

the blockade. In the ensuing battle, lasting two hours, the six Spanish ships were destroyed or beached. The Spanish losses included 350 killed and 1,700 captured; although the American vessels were struck many times, only 10 men were wounded and one killed.

SANTIAM, a North American Indian tribe speaking a dialect of the Kalapooian linguistic stock. They lived on the Santiam River, an eastern branch of the Willamette in Oregon. The tribe was formerly composed of four bands. The granting of land patents to the small number living on the Grande Ronde Reservation in the early part of the present century destroyed their tribal identity.

SANTO DOMINGO, a North American Indian pueblo and tribe of the Keresan linguistic stock. The pueblo is situated on the east bank of the Rio Grande, about 18 miles above Bernalillo in north central New Mexico. The present village, the third known to have been occupied by the Santo Domingo tribe, has been established at its present site for more than 200 years. Its aboriginal name is Kiua.

SANTO DOMINGO or **SAN DOMINGO**, capital city of the DOMINICAN REPUBLIC, situated on the left bank of the River Ozama. The city is poorly built, many of the houses having thatched roofs. The principal buildings are the government palace and the cathedral. A wireless station has been established. Sugar, coffee, molasses and tobacco leaves are the chief articles of trade. The imports include rice, cotton goods, machinery, wheat flour and vehicles. Santo Domingo was founded by a brother of Christopher Columbus, and is one of the oldest European settlements in the New World. Until almost the end of the 18th century the bones of Christopher Columbus were kept in the cathedral. Est. pop. 1928, 45,000.

SANTOS, a city of Brazil and the largest coffee port in the world. Situated in the state of São Paulo, about 232 mi. southwest of Rio de Janeiro, it lies on the island of São Vicente, a low, fertile plain separated from the mainland by the tidal river of Santos, which is faced by stone and cement walls in front of the city. Santos is almost at sea level, and is artificially drained by canals. About 11,000,000 bags of coffee are shipped yearly. Three miles of docks line the coast. Santos has an annual rainfall of about 75 in. The city was founded about 1543. Pop. 1920, 102,589.

SAN VICENTE, a city of Salvador, located about 30 mi. east of San Salvador on the River Acahuapa. The volcano of San Vicente, about 7,000 ft. high, is the most important one in the volcanic district around the town, which is noted for its hot springs and geysers. Some products of the surrounding country are tobacco and indigo and the chief industries of the city are the manufacture of silk and cotton cloth, cigars, shoes and hats. It was founded in 1634 and was the capital of the republic for one year. Pop. 1930, 24,863 with suburbs.

SANYAKOAN, one of the tribes of the North American Indian Tlingit linguistic stock. They lived formerly at Cape Fox in Alaska. They are known

to have had two divisions, the Nehadi and the Tekoedi.

SAO FRANCISCO, a river of South America. It rises in the northern slope of the Tabatinga Range, in the Brazilian plateau, and falls into the Atlantic near the town of Sergipe-del-Rey, Brazil. From about 150 mi. northwest of Rio de Janeiro, and almost in contact with the headwaters of the Paraná branch of the Plata, the River Sao Francisco finds its course of 1,800 mi. to the sea, which it enters over a shallow bar. It is claimed that its lowest 135 mi. are navigable, as also 800 mi. of its upper stretches, the remainder being obstructed by great falls and rapids. The river flows in a broad valley with table-land bluffs on either side. Forests border the immediate banks, behind which are lower levels of lagoons. For three-fourths of its course the Sao Francisco forms a part of the western boundary of the high maritime table-land and mountain belt of Brazil.

SAO LUIS DO MARANHÃO, a city of Brazil and capital of the state of Maranhão, an island of the north coast of the republic. The city lies on a narrow strip of land between two estuaries of the Maranhão River. The streets are steep and unsuited to the use of vehicles, but afford good drainage. São Luis do Maranhão has schools, hospitals and churches. Cotton and sugar are its chief exports. The city was founded in the beginning of the 17th century by the French. Pop. 1920, 52,929; est. pop. 1930, 62,895.

SAO MIGUEL ISLANDS. See AZORES.

SAO PAULO, the capital of the Brazilian state of São Paulo, standing on a wide plain 310 mi. inland from Rio de Janeiro and 50 mi. from Santos. São Paulo well illustrates the rapid increase in population in this part of Brazil, for, from a population of 64,000 in 1890 it had grown to a great metropolis of some 879,788 inhabitants by 1930, the third largest city of South America and the leading industrial center of the continent. The city owes virtually all of this to coffee, although its commanding site relative to access to the coast has been of importance in strengthening its power. It is the most rapidly growing large city of Latin America. Its port, SANTOS, with which it is linked by a single railway over the Serra do Mar, handles about 53% of the exports and 39% of the imports of Brazil. This trade has given rise to a population of more than 100,000 in Santos, which exists solely in the rôle of a port. São Paulo has many large modern mills, notably textile mills.

While lacking Rio de Janeiro's scenic beauty, São Paulo is preferred by many as a place of residence because of its cooler climate, the greater business activity apparent and the cosmopolitan society, more than one-third of the population being of foreign birth and another third direct descendants of Europeans. The city has many splendid buildings, both public and private, including a beautiful opera house and a large number of excellent schools of various kinds. Pop. 1920, 579,933; est. pop. 1930, 879,788.

SAO PAULO DE LOANDA, more commonly called Loanda, a port of Angola on the west coast of

Africa, situated on a small island between the rivers Bango and Kwanza. There are several soap and tobacco factories, an important railroad running eastward, an active department of agriculture and a meteorological observatory. Loanda was the capital of the colony until 1928, when the healthier and more elevated Nôva Lisboa was made the administrative center. Loanda was founded in 1576 and was for a time a center for slave traffic between Portuguese West Africa and Brazil. Pop. about 16,000.

SAO SALVADOR or BAHIA, the oldest city of Brazil, the capital of the Brazilian colonies until 1762 and now the capital of the state of Bahia, on the eastern coast. On the basis of sugar produced about its fine harbor on the Bay of All Saints, by the end of the 16th century the city of São Salvador became the leading center of Brazil. Bountiful fertility of soil, slave labor and ready European markets carried it along on a wave of prosperity. Not only did the city acquire the sugar trade but it also became the principal slave market of South America, a fact notably evident in the high proportion of Negro blood in the population. Abolition of slavery late in the 19th century and growing competition in sugar markets destroyed the power of sugar, but its cultivation continued, together with that of tobacco and small crops, and, to the south of the sugar zone arose the new major industry of the region, the production of cacao.

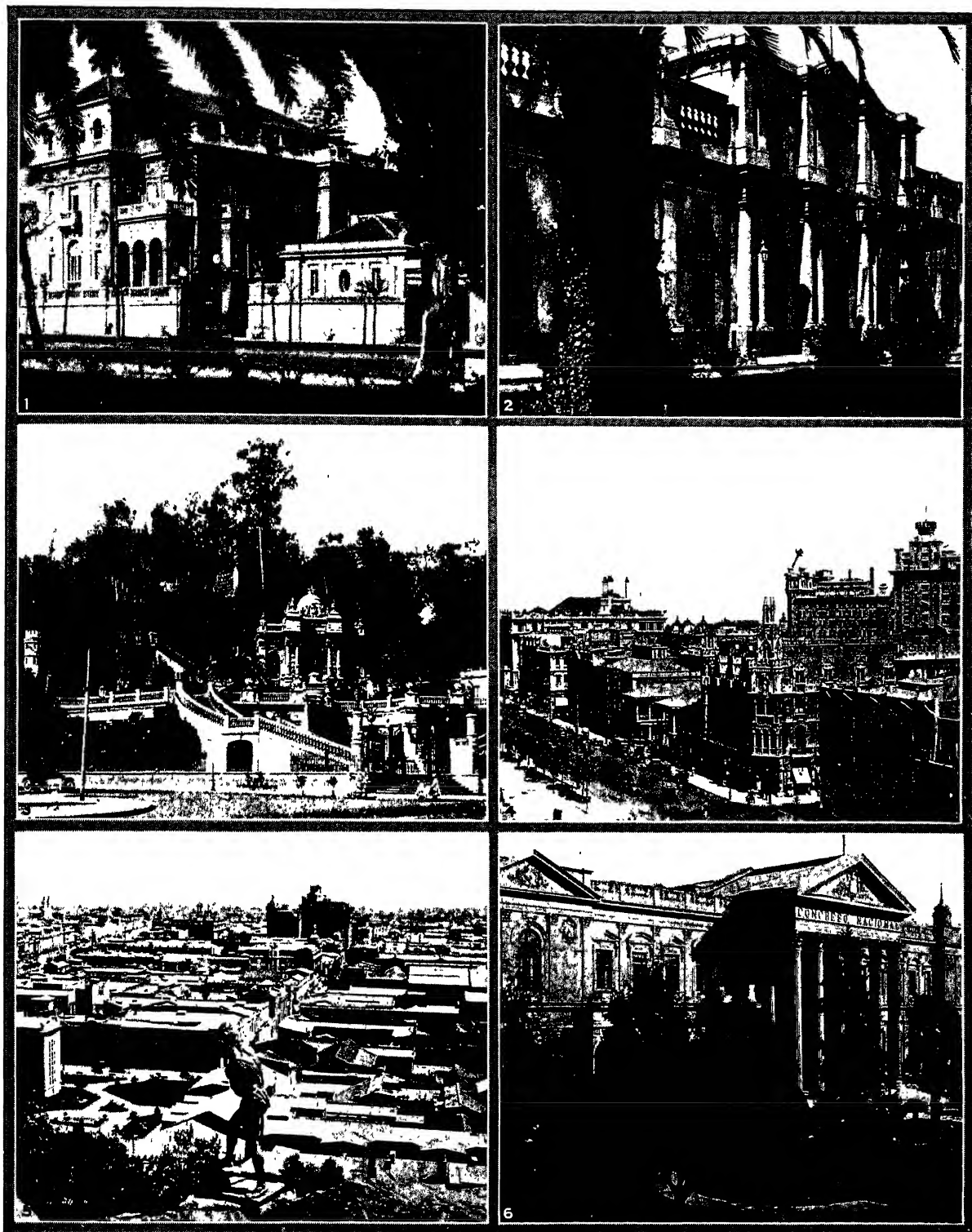
Sao Salvador is easily the third city of Brazil, an important manufacturing center for tobacco, sugar refining, cotton and jute. In addition, this metropolis has a large trade growing out of its connection by rail with the interior, whence come various products, notably diamonds. The mean temperature is 79° F. The annual rainfall is about 53 in. Improved sanitary conditions have helped to eliminate smallpox and other diseases. Est. pop. 1930, 329,898.

SAPAJOU, an American spider monkey. This native name has been used as a synonym for CAPUCHIN, and applied to the whole of the family Cebidæ. It is now usually restricted to the spider monkeys, or coaitas of that family, and particularly to the common coaiti (*Ateles ater*), a coal-black species abundant in Brazilian forests and the most typical of the arboreal monkeys. It is easily captured and reared, and is a favorite pet.

SAPAN WOOD (*Cæsalpinia Sappan*), a small tree of the senna tribe of the pea family, native to the East Indies. It yields a valuable reddish-brown dyewood, known as sapan wood or redwood, from which is obtained a red dye used chiefly in coloring cotton goods.

SAPODILLA (*Sapota Achras*), a large evergreen tree of the sapodilla family, producing a luscious edible fruit. It is a native of tropical America, where its cultivation antedates the Spanish discovery, and is now extensively cultivated in other tropical regions. In the West Indies it is called naseberry; in the Philippines, chico. The apple-shaped fruit, known as the sapodilla or sapodilla plum, contains a delicious, yellowish-brown, translucent pulp. From the

SANTIAGO, CHILE



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VIEWS OF SANTIAGO, CAPITAL OF CHILE

1. The Embassy of the United States at Santiago. 2. La Moneda, the Government Palace and executive residence. 3. Santa Lucía Hill, a park, the site of an historic citadel.

4. The chief thoroughfare of Santiago, the Alameda de las Delicias. 5. Santiago from Santa Lucía Hill. 6. The Congreso Nacional, where the Chilean congress convenes.

tree is also obtained a hard durable wood and CHICLE gum, extensively used in the United States in making chewing gum.

SAPONIFICATION, the process by which, through the medium of water, a glycerine ester is decomposed into its constituent glycerine and fatty acids. It usually means, but not necessarily, the formation of soap by the addition of lye. The similar process taking place more generally in the aqueous solution of any ester which is split into its alcohol and acid, is called **HYDROLYSIS**. By the saponification number is understood the amount of lye required to bind completely all the fatty acids present; it thus gives an indication as to the relative abundance of fatty acids in the substance analyzed.

SAPOTE, a Spanish name applied to several tropical fruits, especially to the marmalade plum (*Achras Zapota*), the sapodilla (*Sapota Achras*) and the white sapote (*Casimiroa edulis*), all of which are sparingly grown in the extreme southern parts of the United States. In the Philippines the date plum (*Diospyros Ebenaster*) is sometimes called sapote.

SAPPHIRE, a precious gem, ordinarily of a rich blue color, which, like the **RUBY**, is a transparent, colored form of **CORUNDUM**. When pure, it is colorless, but usually impurities are present, titanium giving a blue, iron a yellow color. As it ranks next after the **DIAMOND** in hardness, corundum gems are very durable. For this and their color they are valued, as they have little brilliancy or fire, due to low refractivity and weak dispersion. Corundum is aluminum oxide, crystallizing in the **HEXAGONAL SYSTEM**.

True sapphire is blue, the best being royal blue, velvet blue, and cornflower blue. The name sapphire is also applied to gem corundum of other colors, except red, which is the ruby. There are white sapphires, yellow or golden ones, often called oriental topaz, and pale pink sapphires. Green ones are known as oriental emeralds, and violet ones as oriental amethyst. Like the ruby, sapphire is pleochroic, being blue and yellowish blue according to the direction of light transmission, so the cutting is the same as the ruby's. Star sapphires, highly valued, show a six-rayed star in luminous white as described for the ruby.

Sapphires are found in the same formations as rubies. The mining, uses, and artificial manufacture are also similar. Important production comes from deposits in Siam and Ceylon. In Ceylon the sapphires are in gneiss, and the rubies in limestone. Montana river sands also produce sapphires. *See also* **GEM STONES**; **PRECIOUS STONES**; **MINERALOGY**; **GEOCHEMISTRY**.

BIBLIOGRAPHY.—George F. Kunz, *The Curious Lore of Precious Stones*, 1913; E. H. Kraus and E. F. Holden, *Gems and Gem Materials*, 1925.

SAPPHO (c. 600 B.C.), Greek poetess, was a native of Lesbos. She was a contemporary of **ALCAEUS**, who greatly admired her, and together they were the chief creators of Aeolian lyric poetry. About the beginning of the 6th century B.C., Sappho was forced to flee to

Sicily, but returned to her native Mytilene in Lesbos, where she became the head of a female literary school. The scandals surrounding this school are apparently baseless. Likewise lacking confirmation is the well-known legend of her death-leap into the sea from the Leucadian rock because of her unrequited love for Phaon. Sappho's lyric poems formed nine books in antiquity. Only fragments remain to us, the chief one being the impassioned *Ode to Aphrodite*. Her odes were mainly composed in the sapphic meter named after her. The passionate sincerity, the delicacy and grace of the poems were highly praised by the ancients, who compared Sappho to Homer. Even the few extant fragments have inspired moderns like Swinburne with unbounded enthusiasm. *See also* **GREEK LITERATURE**.

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SAPROPHYTES, a group of well-named plants, because *sapro*, rotten, and *phyte*, plant, describes their habit of living on the dead remains of other plants. Saprophytic fungi are very common, and the characteristic is widely dispersed among the flowering plants.

Saprophytes are not parasitic, although some, like the Indian Pipe are mistaken for parasites, perhaps because many saprophytes, like some parasites, have little or no chlorophyll. Many parasites, however, are green plants, which differ from ordinary ones only in their peculiar food habits.

The ability of saprophytes to absorb the products of decay, which some of them help to hasten, is based upon the fact that in decayed vegetation are readily available food materials which, in forests, may be unavailable as mineral soil. All degrees of saprophytism are found from such total saprophytes as the Indian Pipe to many plants of the figwort family. In the latter there are species which are saprophytes for part of their life, but wholly autophytic for the rest of it.

Many plants of the forest floor are partial or total saprophytes, **HUMUS**, of course, being the most widespread source of food materials. Much of the saprophytism of the flowering plants depends upon microscopic organisms of decay, many of which are themselves saprophytic fungi, algae or bacteria. *See* **PARASITIC PLANTS**, **MYCORRHIZA**. N. T.

SAPUCAIA NUT, the name given to the large oily edible seeds of a Brazilian tree (*Lecythis Zabucajo*) allied to the **BRAZIL-NUT**. They are somewhat triangular in shape, with a thick corky shell. Though of a more delicate flavor, the kernel otherwise resembles that of the brazil-nut. The seeds are borne within a huge woody capsule, 6 to 8 in. across, fitted at the top with a roundish lid. *See also* **MONKEY-POT**.

SAPULPA, a city in northeastern Oklahoma, the county seat of Creek Co., situated 15 mi. southwest of Tulsa. Two railroads serve the city. There is an emergency landing field. Splendid oil and gas fields lie in the vicinity. Cotton, corn, and oats are the chief crops of the region. The city is an industrial

center, manufacturing glass and oil products. The factory output, 1929, was worth \$1,220,128. In 1929 the retail trade was valued at \$7,263,549. Sapulpa was incorporated in 1886. Pop. 1920, 11,634; 1930, 10,533.

SARABAND, a stately Spanish dance in triple meter, characterized by an accent on the second beat of each measure. The form and name were incorporated in the *SUITE*, usually occurring as the third movement, following the *COURANTE*. Shakespeare refers to the saraband as "A measure full of state and ancients."

SARACEN. The Romans called the Bedouins who harassed the Syrian frontiers Saracens. Some have derived the name from an Arabic word meaning easterner. In medieval times the name was applied to the Arabs and generally to all Moslems. Modern practice tends to confine the term to Moslem history prior to the Turkish conquests, describing as the Saracen Empire and Saracen civilization the period of the first four orthodox Caliphs and the Ommaiad and Abbasid dynasties.

SARAGOSSA (Spanish *Zaragoza*), a city of Spain, capital of the province of the same name and of the former kingdom of Aragon, on the Ebro River. Apart from the sections rebuilt after the devastation of 1808-09, it consists of irregular streets, intersected by the main street, the *Coso*. A stone bridge of the 15th century spans the river at this point. The most noteworthy buildings are the Gothic cathedral, built 1119-1520; the cathedral, Nuestra Señora del Pilar, 1681, with a pillar dedicated to the Virgin Mary; the Church of San Pablo, built 1259 in the Transition style; the Gothic abbey Santa Engracia; a citadel once used as residence of the kings of Aragon; the Gothic stock exchange of 1551; the Archbishop's palace; several palaces of nobles, and the new university. The active industries of earlier times are now restricted chiefly to leather, woolen and silk goods, buttons, hats, soap and chocolate. There is considerable trade. Est. pop. 1929, 157,399.

SARAGOSSA, BATTLE OF, 1710, a battle fought at Saragossa, a Spanish city, during the WAR OF THE SPANISH SUCCESSION, between the Spaniards under Philip V and the Allied forces of Austria, Britain, Holland and Portugal, commanded by Archduke John of Austria. It resulted in a sweeping victory and possession of Saragossa for the Allies. In the PENINSULAR WAR, Saragossa was unsuccessfully besieged by the French from June 5 to Aug. 15, 1808. On Dec. 20, the city was again besieged by the French, and the Spanish leader, Jose de Palafox Y Melu, showed signal bravery in his resistance which lasted until Feb. 20, when Saragossa was captured by storm. During this siege, Maria Agustin, famous as the Maid of Saragossa, replaced her wounded lover at the guns.

SARAH, in Biblical history the wife of the patriarch Abraham, who married her, according to one account, when he was 65 years old. A number of Biblical passages deal with the promise that the barren Sarah would ultimately give birth to a son

whose descendants would inhabit Canaan. In fulfillment of the divine promise, Isaac was born.

SARAH LAWRENCE COLLEGE, an experimental junior college for girls in Bronxville, Westchester Co., N.Y. It was founded in 1926 by William Van Duzer Lawrence as a memorial to his wife, Sarah Bates Lawrence. In its two-year courses the college endeavors to give new and added value to studies in the arts and liberal arts by means of informal classes, discussion groups, strong personal contacts and extra-curricular work. In 1930-31 Sarah Lawrence College enrolled 286 students and had a faculty of 46 members, headed by Pres. Constance Warren.

SARAJEVO, a city of YUGOSLAVIA, capital of the former province of Bosnia, situated in picturesque hills on the banks of the Miljatska River. The Turkish wooden houses with latticed windows, carved doors, and the minarets of the hundred mosques which rise above them give the town a distinctly oriental appearance. The most notable of the mosques is Begova Djamia, adjoining the bazaar. It was built by Husref Bey in the 15th or 16th century and is considered one of the three finest European mosques. Other important buildings are the cathedrals of the Roman Catholic and Orthodox churches, the *rathaus*, or town hall, and the Bosnian national museum. Sarajevo is the see of a Roman Catholic bishop and an orthodox metropolitan, as well as the seat of the highest Moslem ecclesiastical authority in Yugoslavia. Among educational institutions are a state-maintained school for Moslem law students, a teachers' training college, a technical institute and numerous secondary schools.

Sarajevo dates from the 13th century and derives its name from *serai*, Turkish for palace. Having been conquered by King Mathias I of Hungary and Prince Eugene of Savoy and repeatedly ravaged by fire, the Turks in 1850 made it the capital of Bosnia. Twenty-eight years later it became the administrative center for Bosnia and Hercegovina under Austro-Hungary. It was here by the bank of the Miljatska that the Serbian student Prinzip assassinated the Austrian Archduke Francis Ferdinand in 1914, the formal cause of the WORLD WAR.

Sarajevo is an important grain and vegetable market. Chief among its manufactures are copper, brass, potteries, silks, carpets and embroideries. Here are also flour mills, a brewery, and tobacco factories. Weaving on hand-loom is still carried on extensively. Pop. 1931, 78,182.

SARAJEVO, THE ASSASSINATION OF, the murder of Archduke Francis Ferdinand and his wife at Sarajevo, June 28, 1914. It was the immediate cause of the WORLD WAR. The Jugoslavs became bitterly hostile to Austria after the annexation of Bosnia and Herzegovina, 1908, because this apparently frustrated their hopes for a Greater Serbia. After the Balkan Wars, 1912-13, when Austrian and Italian diplomacy prevented Serbia from obtaining access to the Adriatic, the anger of the Serbs greatly increased. It was therefore a rash undertaking for the Archduke

Francis Ferdinand, nephew and heir of the Emperor Francis Joseph, to visit Sarajevo, the little capital of Bosnia, on June 28, 1914, the anniversary of the Battle of Kossovo, 1389, a day of Serbian mourning, especially when he did so without adequate provision for protection. As the Archduke and his wife drove through the streets a bomb was thrown that injured one of their suite. They proceeded to the town-hall, listened to an address of welcome from the Mayor and reentered their automobile. On their way to the hospital to visit the wounded adjutant, they were both shot and killed by a Bosnian youth, Gavrilo Princip. With two Bosnian fellow conspirators, he had been living in Belgrade, where Col. Dimitriyevitch of the Serbian General Staff and the leader of the so-called Black Hand seems to have furnished them with revolvers. In spite of much evidence that has come to light the ultimate responsibility for the crime has not been clearly determined. The Austrian and Russian as well as the Serbian Governments have been suspected, probably unjustly, of guilty knowledge, if not actual complicity. On the other hand it is certain that prominent Serbians were directly involved in the conspiracy.

SARANAC LAKE, a village famous as a health center for tubercular patients, in northeastern New York, situated on the boundary of Essex and Franklin counties, in the Adirondack Mountains, near Lower Saranac Lake, 40 mi. south of Malone. It is served by two railroads. Dr. Edward L. Trudeau founded a sanatorium in 1884, now known as the Trudeau Sanatorium, which is located near the village of Saranac Lake. He also organized the Saranac Laboratory for Research in Tuberculosis. Out of this grew the Trudeau School of Tuberculosis, which gives special courses to physicians in the diagnosis and treatment of the disease. There are several other institutions in the neighborhood, including the New York State Sanatorium and the National Vaudeville Artists' Sanatorium. In 1892 the village was incorporated. Saranac Lake is also popular as a pleasure resort, with ample facilities for summer and winter sports. Pop. 1920, 5,174; 1930, 8,020.

SARAPIS. See **SERAPIS**.

SARASOTA, a port city on the western coast of Florida, the county seat of Sarasota Co., situated on Sarasota Bay, an inlet of the Gulf of Mexico, 50 mi. south of Tampa. Buses, steamships and two railroads serve the city, which is an attractive winter resort. Celery and strawberries are the chief crops of this region. Sarasota is the winter quarters of Ringling Brothers' circus, and is the home of the John and Mabel Ringling Museum and of the Ringling Art School. The city was founded about 1880; incorporated in 1913. Pop. 1920, 2,149; 1930, 8,398.

SARATOGA, BATTLE OF, Oct. 7, 1777, an engagement of the REVOLUTIONARY WAR which resulted in the decisive defeat of the British army under Burgoyne. This shattered the plans of the British Ministry for the conquest of the Northern colonies. Having failed to gain Bemis Heights in his first

attempt, Burgoyne with 1,500 men made a second assault. American detachments under Generals Poore and Morgan checked the attack until Benedict Arnold, technically relieved of his command, dashed forward and led the Americans in a victorious counter-assault. The British retreated, encamping at Saratoga, now Schuylerville. The American army, nominally under Gen. Gates but actually commanded by the various subordinate generals, maintained a continual bombardment and cut off Burgoyne's avenues of supply. On Oct. 17 the British army of about 5,500 men was formally surrendered to Gates. The news of the failure of Burgoyne's expedition was a potent factor in persuading the French Government that the time had come for a formal alliance with the United States.

SARATOGA SPRINGS, a city and famous watering resort in Saratoga Co., eastern New York, situated near Saratoga Lake, 30 mi. north of Albany. Railroads, airports and bus lines serve the city. The mineral springs, alkaline-saline with supersaturation of carbonic acid gas, and their curative properties draw thousands of tourists and patients suffering from heart, joint and other diseases. The value of the springs was known to the Indians who brought Sir William Johnson, the first white man "to take the cure," here in 1707.

Saratoga Springs known as the Queen of Spas, has always been fashionable and gay, save for short periods of depression. At one time it was notorious for its horse racing activities and gambling houses, especially Canfield's, later called the Casino. The races are held in August under the auspices of the Saratoga Association for the Improvement of the Breed of Horses. Exploitation for private gain for some time threatened to extinguish the flow of the waters completely. To prevent such a disaster the State took over practically all of the mineral springs in the vicinity of Saratoga and now has under its control on the reservation 1,100 acres of land containing 122 mineral wells and springs. The Convention Hall seats 5,000 people. The two battles of Saratoga (see **SARATOGA, BATTLE OF**) fought Sept. 19th and Oct. 7th, 1777 on Bemis Heights are commemorated by a State Military Park, established by the State in 1926. Saratoga Springs village was incorporated in 1826; made a city in 1915. Dairying is the leading interest of the countryside. The city has some manufactures, including drugs, wall-paper and clothing, also large mineral water bottling works. The manufactured output for 1929 was valued approximately at \$1,600,000; the retail business in 1929 amounted to \$10,818,334. It is the seat of SKIDMORE COLLEGE FOR WOMEN. Pop. 1920, 13,181; 1930, 13,169.

SARATOV, largest city on the Volga, and administrative center of the Lower Volga Region of the R.S.F.S.R., on a lofty plateau surrounded by high mountains. The town is the headquarters of the Russian corn trade and a transshipment point for oil products. Corn-grinding is its principal industry, others being the manufacture of foodstuffs and hardware. There are sawmills, railway repair shops, iron-smelting

works and an electric plant. Saratov is a notable cultural center, possessing two universities, almost a dozen museums, numerous scientific institutions and industrial schools. Of many churches and cathedrals, the Troitzky Cathedral, constructed in 1697, represents a rare and distinctive type of Russian Baroque architecture. Founded as a fort in 1590, it repelled invasions and took part in the rebellions of Stepan Razin and Pugachev. Russians compose 85% of the population. Pop. 1930, 237,526.

SARAWAK, a British protectorate on the northern coast of Borneo. See BORNEO.

SARCOMA. See TUMORS.

SARD, a rare and very valuable variety of carnelian, showing deep red against the light. As a gemstone, the sard has a long history, appearing in Assyrian seals and Egyptian and Phoenician scarabs. The first stone in the breastplate of the Hebrew high priest was probably sard. It was anciently believed to keep off witchcraft and "noxious humors," and to induce courage.

SARDINE, a name applied to various small food fishes of the herring family with rich flesh and feeble bones suitable for preserving in oil. The European sardine (*Sardina pilchardus*), called pilchard in England, is immensely abundant around the island of Sardinia, whence the name sardine, and in other Atlantic waters from the Mediterranean to the Baltic. On the coast of Cornwall sardine fishing is an important industry. The California sardine (*S. caerulea*), called also PILCHARD, is very abundant from Puget Sound southward to Magdalena Bay. When full grown it is about 12 in. long, dark blue above and silvery below with round black spots on the sides. The young fish, a few inches long, are taken in immense quantities for canning. In 1929 the total catch of California sardines amounted to 651,802,000 lbs., valued at \$3,588,000; the canned fish, amounting to 183,898,320 lbs., was valued at \$11,996,997. On the New England coast large quantities of young HERRING (*Clupea harengus*) are similarly preserved and sold as sardines. In 1929 this canned product amounted to 50,645,025 lbs., valued at \$6,897,946.

SARDINIA, an island of the Mediterranean lying 7 mi. south of Corsica and at a considerable distance west of the southern part of Italy, of which it forms a territorial division. It has a maximum length of 164 mi., an average width of about 60 mi. and an area of 8,187 sq. mi. The island is dominated by a series of mountain ranges which are broken up by valleys. The peaks, some of which are volcanic in origin, range in height from 2,000 to nearly 6,500 ft.

Sardinia was made a part of the duchy of Savoy in 1720. In 1861 VICTOR EMMANUEL II, king of Sardinia, became king of United Italy. Agriculture, mining and the raising of live stock are the principal industries of Sardinia. The crops include wheat, barley, tobacco, oats, potatoes and beans. Grapes, oranges, lemons, olives and chestnuts are grown in large quantities. The uplands of the island are devoted to pastures, where sheep and goats, horses and

cattle are bred. The principal mineral products are zinc, iron, coal, lead and antimony. Politically Sardinia is divided into three provinces, Cagliari, Nuoro and Sassari. Cagliari is the capital. Island pop. 1928, 955,303.

History. The prehistoric inhabitants of Sardinia were conquered by the Carthaginians about 480 B.C. Some settlement was made and the island was civilized before the Roman conquest in 238 B.C. Thereafter Sardinia continued as an unimportant Roman province, furnishing grain and salt and acquiring the Latin language, but taking little or no part in the life of Rome. After the 5th century A.D., the island was successively conquered by the Vandals, Byzantines and Saracens, but was never firmly held by any, and fell into anarchy and brigandage.

The Papacy, which claimed suzerainty over the island, granted it to Pisa in 1022. The Saracens were driven out without difficulty, but the Pisans occupied only such parts of the country as were commercially profitable to them, and left the government to the rich Pisan families settled there. During the 12th century the Genoese took advantage of this loose Pisan grip to take parts of it for themselves, and for 200 years the commercial wars of Pisa and Genoa had their disastrous repercussions in Sardinia. Finally in 1297 Pope Boniface VIII granted the island to James II of Aragon, and by 1326 the Aragonese were in complete control.

The union of Aragon and Castile to form the kingdom of Spain had no effect in Sardinia, and for nearly 400 years it remained a Spanish possession. At the close of the WAR OF THE SPANISH SUCCESSION it was handed to Austria for a few years, but in 1720 in exchange for Sicily, it went to the dukes of Savoy, carrying with it the ancient, and long empty, title of King of Sardinia created in 1164 by the Emperor Frederick I. Thereafter throughout the Napoleonic wars and the unification of Italy Savoy acted under the name of the kingdom of Sardinia; but these events affected the island little if at all. At length in 1861 the title of King of Sardinia lapsed with the creation of the kingdom of Italy.

SARDINIAN, the ROMANCE dialects of Sardinia, of which Campidanian and Logudorian, spoken in the interior of the island, are noteworthy as being the only members of the Romance group, at least in the west, which have not changed VULGAR LATIN *i* to *e* and *u* to *o*, or palatalized Latin *c* before *i* and *e*, e.g., Latin *pilu*^m, "hair," remains *pilu*, as against Italian and Spanish *pelo* and French *poil*; so also Latin *bucca*, "mouth," remains *buka* as against Italian *bocca*, Spanish *boca*, French *bouche*; Latin *centum*, "hundred," remains *zentu* as against French *cent*, etc. The group *ll* becomes *dd*, e.g., Latin *cerebellum*^m, "brain" = Sardinian *karveddu*, as in many South-Italian and Sicilian dialects.

H. F. M.

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SARDIS, or Sardes, the ancient capital of Lydia, was a city of military importance on account of its



SARGENT

"VENETIAN CANAL"

By John Singer Sargent (1856-1925), in the Metropolitan Museum of Art.

commanding view of the plain of the Hermus, the citadel of Sardis being built on a spur of Mt. Tmolus. Here, too, halts were made on the roads used by traders between Persia and Europe. The carpets and woolens of Sardis were famous. In Roman times it was the seat of a conventus. The Cimmerians burned the city in the 7th century B.C., the Greeks burned it in the Ionic revolt and Antiochus the Great in 215 B.C. Under Tiberius an earthquake destroyed Sardis, but after each of these catastrophes the city was restored. The ruins are mostly Roman.

SARDONYX, a form of onyx which displays alternate layers of milk-white chalcedony with brownish sard or red carnelian. From ancient times to the Renaissance gem-cutters valued this stone for the making of seals and cameos. Fine sardonyx was anciently obtained from India. Modern stones are commonly South American agate artificially colored. The famous ring given by Queen Elizabeth to Essex was a cameo-cut sardonyx.

SARDOU, VICTORIEN (1831-1908), French dramatist, was born at Paris, Sept. 7, 1831. He lived through a period of desperate struggle before his plays won success, but he was still a young man when Mlle. Dejazet accepted several dramas and his recognized "career" began. He was soon classed with *DUMAS fils* and *ÉMILE AUGIER* in leadership of the French theater. In 1877 he was elected to the French Academy. Among his most celebrated works are *Les pattes de mouche*, 1860, done in English as *Scrap of Paper*; *Nos intimes*, 1861, translated as *Peril*; *Fédora*, 1882, written for *SARAH BERNHARDT*; *Robespierre*, 1899, for *SIR HENRY IRVING*; *La Tosca*, 1887, for which *GIACOMO PUCCINI* composed the opera; *Madame Sans-Gêne*, 1893, and *La Sorcière*, 1903. He died at Paris, Nov. 8, 1908.

SARGASSO SEA, a large area of the north Atlantic Ocean covered with floating and drifting seaweed, and planktonic plants. (See *PLANKTON*.) It occupies the central, rather stagnant region around which the principal currents in the Atlantic form an eddy. The north equatorial current flows westward from Africa toward the West Indies, emerges from the Gulf of Mexico as the Gulfstream, turns first north then eastward, and finally sends one branch southward again, via the Azores, to reach the north Atlantic current, and complete the circuit. The Sargasso Sea occupies an area extending some 2,000 miles from west to east, and 400 miles from north to south. It lies to the southwest of the Azores, though its actual position depends upon wind and currents. The name is derived from the Portuguese *sargação*, their description of what is now known as gulfweed, one of the algae, brownish in color, possessing berry-like bladders, and supporting a good deal of the lower forms of marine life. In former days the story was told of ships that had become involved in it and were unable to extricate themselves, but this has now been relegated to pure fiction.

SARGASSO WEED, a brown seaweed found floating in immense abundance in the Gulf of Mex-

ico, forming a characteristic feature of the so-called Sargasso Sea. See *GULFWEEED*.

SARGENT, CHARLES SPRAGUE (1841-1927), American dendrologist, was born at Boston, April 24, 1841. Graduating from Harvard University in 1862, he served as an officer during the Civil War. From 1872 to 1879, he was director of the Arnold Arboretum, Cambridge, and in 1879 he became professor of arboriculture at Harvard University. Sargent was one of the leaders of the movement to preserve the American forests. In 1885 he acted as chairman of the New York State Commission on forest preservation in the Adirondack Mountains and from 1887 to 1897 he edited *Garden and Forest*. He wrote *The Woods of the United States*, *Catalogue of Forest Trees of North America*, *The Forest Flora of Japan*, *Silva of North America*, and *Manual of the Trees of North America*. Sargent died at Brookline, Mass., March 22, 1927.

SARGENT, JOHN SINGER (1856-1925), Anglo-American painter, was born in Florence, Italy, Jan. 12, 1856, of American parents. He studied at the Academy of Fine Arts in Florence and under Carolus-Duran in Paris; in 1879 he visited Spain to study Velasquez. The first of his many visits to America was made in 1876. The painter resided in Paris until 1884, then moved to London, where he lived until his death, Apr. 15, 1925. Sargent was early recognized a master in the art of portraiture. His best known works in this field are probably the famous *Madame X*, dated 1884, *Ellen Terry as Lady Macbeth*, 1899, and the *Daughters of the Hon. Percy Wyndham*, 1900. In 1910, at the height of his fame as a portraitist, Sargent gave up the painting of portraits and devoted himself to decorations. His murals *The History of Religion*, in the Boston Public Library, are among the finest works of the kind. Late in life he turned also to water color painting, with admirable results. He was elected to the Royal Academy in 1897, and to the American Academy of Arts and Letters in 1905. Sargent is represented in all of the leading galleries of the world. The Metropolitan Museum, New York, and the Boston Fine Arts Museum have particularly fine collections of his works.

SARGON, the name of several ancient kings. The most important are Sargon of Babylonia and Sargon of Assyria. The first was the earliest king of Babylonia within historical times. Little is known of him, but he is believed to have reigned over the northern part of Babylonia about 3800 B.C. The second Sargon was probably a usurper to the throne of the Assyrian empire. He took the title of king in 722 B.C. and almost at once began the military campaigns against neighboring nations which resulted in the consolidation of his domains. He is believed to have conquered Samaria and Babylonia, and to have taken prisoner over 25,000 Israelites. Sargon was unscrupulous in his treatment of enemies, but wise and just in ruling his own people. He died in 705 B.C.

SARMATIAN, an extinct Iranian language of the INDO-IRANIAN branch of the INDO-EUROPEAN linguistic

family, closely related to SAKIAN and finding its closest modern representative in OSSETIC. It is known only from glosses and proper names recorded by classical writers, and from a few traces in the geographical nomenclature of southern Russia.

SARMATIANS (Sauromatae, Sarmatae), an Iranian tribe resident in southern Russia from the fourth century B.C. Driven westward by the uneasy movements of the central Asiatic Mongols, they extended as far west as the Don River by the time of Herodotus. Crossing this river, they pushed the Scythians into the Dobrudja and the Crimea. By the end of the second century B.C., the Iazygians, the Sarmatian advance-guard, had penetrated as far west as the Danube, and by the beginning of our era the Sarmatians were already a menace to the eastern confines of the Roman Empire. The easternmost section of the Sarmatians, known as the ALANS, persisted as the dominant element in southern Russia till the third century A.D. The Sarmatians absorbed the cultural heritage of the Scythians, had no hesitation in attacking the Greek colonies of the Crimea, and served in large numbers as mercenaries in the armies of Mithradates. Prior to their exposure to Scythian and Greek culture, they were shepherds. Their historical importance wanes with the HUN incursion of 375.

SARMIENTO, DOMINGO FAUSTINO (1811-88), Argentine writer, orator, journalist and statesman, known as the schoolmaster President of Argentina. He was born of pure Spanish stock on Feb. 15, 1811 at San Juan de la Frontera, and received little formal education. He opposed Rosas and went into exile to Chile, where he dedicated himself to education and journalism. As a result of a visit to the United States (1846) he became not only a federalist but the friend of Horace Mann and other prominent educators and scholars. In 1852 he assisted in the successful war against Rosas. After 1862 his public life in Argentina began. In 1868, while Argentine minister in Washington, he was elected President of Argentina, serving until 1874. He brought to a close the Paraguayan War (1865-1870) and contributed much to the improvement of the educational system of the nation. He had a census taken, the first in the republic (1869). Sarmiento was a noted scholar and a prolific writer, the author of more than 52 volumes. Some of the representative are *Facundo o la civilizacion y la barbarie* (1845); *Recuerdos de provincia* (1850); *Vida de Lincoln* (1866), and *Las Escuelas: base de la prosperidad y de la republica de los Estados Unidos* (1866). Sarmiento died in 1888.

SARNIA, a city and the capital of Lambton Co., a port of entry in Ontario, Canada, situated on the St. Clair River, near its mouth at Lake Huron, 60 mi. northeast of Detroit, Michigan. Most of the Ontario oil production is refined here and shipped through Sarnia. There are factories making plumbing goods and steel bridges and treating salt. The city is port of call with a good harbor, grain elevators and storage facilities, a landing place for Great Lakes steamers, and the terminus of the Canadian National Railway

and the St. Clair Tunnel, 6,025 ft. long, to Port Huron, Mich. With beaches and other recreational attractions, Sarnia is favored as a summer resort. Founded in 1832-35, it was incorporated in 1914. Pop. 1921, 14,877; 1931, 18,191.

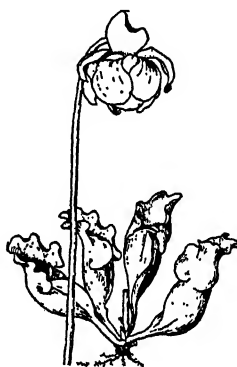
SAROS, the interval of 18 years 11 days between two similar eclipses of the sun or moon, known to and named by the Chaldeans.

SARPSBORG, a city of Norway in the district of Ostfold on the railroad between Goteborg and Oslo and on the Glommen River, whose large waterfalls are near the city. The power plant is of 70,000 H.P. and operates cellulose, paper, woodpulp, electro-chemical and carbide factories and sawmills. The river is spanned by a two-story bridge for railroad and vehicular traffic. The city was founded in 1016. It was entirely destroyed by the Swedes in 1567 and was not rebuilt until 1839. Pop. 1930, 12,392.

SARRACENIA, a genus of pitcher plants found in eastern North America. There are seven species, native chiefly to sunny bogs and marshy places in the southern states. They are low herbs with rosettes of root leaves; each leaf is in the form of a long, narrow, often brightly colored pitcher with a flat green wing on the lower side. In structure the pitcher resembles that found in *Nepenthes*. There is a lid projecting more or less over the mouth around which are



NORTHERN PITCHER PLANT
Entire leaf and cross section



P. A. RYDBERG "FLORA OF PRAIRIES
AND PLAINS"

NORTHERN PITCHER PLANT
Sarracenia purpurea

many honey-glands. Below these glands is a smooth area or slide zone, then an area covered with stiff downwardly pointing hairs and at the bottom water in which entrapped insects are drowned and the bacterial decomposition of their bodies assimilated to some extent for food. The common pitcher plant or side saddle flower (*S. purpurea*) grows in peaty bogs from Labrador to Alberta south to Florida and Iowa. Among the species found in the southern states, all commonly called trumpets, are the trumpet-leaf or watches (*S. flava*), the red-flowered trumpet-leaf (*S. variolaris*), the veiny trumpet-leaf (*S. Drummondii*) and the parrot-beaked pitcher plant (*S. psittacina*). See also CARNIVOROUS PLANTS; INSECTIVOROUS PLANTS; NEPENTHES; PITCHER PLANTS.

SARREBOURG, the chief city of the Sarre Territory, seat of its provisional government under the League of Nations, and the industrial and commercial center of the great coal basin of the Sarre on the France-German frontier, north of Lorraine. The name of the city comes from the bridge, which was there in Roman times. Long in the possession of feudal counts Sarrebourg passed to France in 1801 and in 1815 to Prussia. The first engagement of the Franco-German War took place here on Aug. 2, 1870. Pop. 125,020.

SARSAPARILLA, a drug obtained by drying the long fibrous roots of several Mexican, Central American and South American species of *Smilax*, thorny perennial climbers of the lily family. Sarsaparilla was introduced into European medicine about 1550 and soon became a popular drug reputed to possess tonic and alterative properties. In modern medicine it is regarded as having but slight therapeutic value. Preparations from the roots of various other plants are known as sarsaparilla. The wild sarsaparilla (*Aralia nudicaulis*) of the eastern United States is collected in limited quantities for the drug trade.

SARSI, a tribe of North American Indians speaking a dialect of the Athapaskan linguistic stock. When first encountered in 1754 they were living in the region of the headwaters of the south Saskatchewan river east of the Rocky Mountains in Alberta, Canada. In material culture, ceremonials and religion they resemble the BLACKFOOT tribes with whom they have intermarried extensively. Since 1881 when their lands were ceded to Canada by treaty they have lived on a reservation south of Calgary.

SASKATCHEWAN, a province of Canada, the middle of the three Prairie Provinces, bounded on the north by the Northwest Territories, on the south by the international boundary line between Canada and the United States, Manitoba on the east, and Alberta on the west.

Area and Population. The area of the province is 251,700 sq. mi. Of this 8,319 sq. mi. are covered by water. With the expansion of the railways, the population has notably increased. At the census of 1901 the number of inhabitants was 91,279; in 1911, 492,432; in 1921, 757,510; and in 1931 the population was 921,785. The English-speaking element predominates, the settlers having arrived from eastern Canada, Britain and the United States. Other nationals occur in a few settlements.

The southern portion of Saskatchewan occupies a part of the plains region, while the northern portion is a part of the Laurentian plateau. The province is crossed in the south by the second and third prairie steppes, both of which have a rolling surface. Extensive forests extend from the prairies to the northern boundary. In the southwest the surface is almost flat. Saskatchewan has no elevations of striking prominence.

Rivers and Lakes. The province has a main easterly slope, draining almost entirely into Hudson Bay eventually, though by widely separated courses.

A large area in the northwest corner falls within the Arctic watershed, while a few small streams in the hilly section adjoining the international boundary find their way through a maze of tributaries into the Mississippi. The north and south Saskatchewan rivers, which rise in the Rockies, with the Qu'Appelle and Carrot rivers, form the chief waterways, intersecting the province from west to east. The northern portion of the province is drained by the Churchill River and its tributaries. The largest lakes are REINDEER, Wollaston and ATHABASKA, all in the northern portion of the province.

Water Power Resources. The water powers are situated chiefly in the northern unpopulated areas of the province, on the CHURCHILL, SASKATCHEWAN, Reindeer and Black rivers. At an ordinary six months flow there are about 1,080,000 h.p. available, but as these resources are situated far from centers of population their full development must await expansion of adjacent natural resources, such as pulpwood or minerals.

Forestry. Although about one-half of the province is forested, so much timber has been damaged by forest fires that the actual forest area probably does not exceed 50,000 sq. mi. Only small areas of virgin lumber are to be found. On about one-quarter of the forest area has the growth attained sufficient size for pulpwood. The saw timber is confined to about 2,500 sq. mi. The area north of the Churchill River contains little lumber of merchantable value, but it provides shelter and fuel for the traders, trappers and prospectors who inhabit the region. The belt that contains the merchantable timber extends from Churchill River to Prince Albert; east of Prince Albert it extends south of the Saskatchewan River. Spruce, poplar, larch and white birch give an annual timber production valued at about \$2,250,000. The principal lumbering area is north of Prince Albert National Park. Large areas have been set aside as forest reserves to conserve the supply, and also to protect the fountain head of streams.

Fisheries. The fishing industry is carried on almost entirely during the winter, the chief exception being sturgeon fishing. Whitefish, pike and perch are caught in nets placed beneath the ice on the lakes. Freezing as soon as taken from the water, they are packed and sent in this condition direct to market, and yield an annual revenue of about \$500,000. Fish culture is conducted by the Dominion government. Many thousands of trout fry are distributed every year from the hatchery at Fort Qu'Appelle.

Furs. The principal channels of the fur industry are still the old routes long used by the Hudson's Bay Company. From Fort McMurray on the Athabaska to the Pas on the Saskatchewan the route leads right across the province. There are historic trading posts at Ile à la Crosse, Stanley, Cumberland House and elsewhere. In the more settled parts of the province business houses, from the rude log cabin to the modern departmental store, are found. A profitable industry in fur trading centers at Battleford and

SASKATCHEWAN

PRINCE ALBERT, with an annual output valued at \$2,400,000. The fur-bearing animals present in large numbers in the forests of the north are bear, beaver, marten, otter, mink, skunk and wolf.

Mining. Saskatchewan has not played a large part in the mineral production of Canada. The minerals of the area to the north are being increasingly exploited by systematic prospecting. The lignite deposits of the south have been worked for many years; about 450,000 tons are taken annually. A recent development in this area is the construction at Bienfait of a plant for the briquetting of lignite coal. Briquettes stand shipment as well as anthracite. It is estimated that there are at least 2,000,000,000 tons of coal in southern Saskatchewan. The clay deposits of the province are important, the annual value of clay products exceeding \$300,000.

MINERAL PRODUCTION, SASKATCHEWAN, 1929

Item	Production	Value \$	Rank Among Provinces
Coal	tons 580,189	993,226	
Clay products	502,522	
Sand and gravel ..	3,496,679	687,646	
Other products ..		70,112	
Total all products		2,253,506	

Climate. In winter the days and nights are very cold, but the high elevation of from 1,200 to 3,000 ft. above sea level renders the atmosphere generally dry and clear. Short periods of severe blizzards occur. The summers have high day temperatures and cool nights. There is much sunshine throughout the year. The average annual precipitation is nearly 17 in., and rainfall is heavy in the north and light in the south. Much of it falls during May, June and July, when it is most effective from the grain growers' point of view.

Soil. The outstanding characteristic of the prairie soils of the province is their large proportion of vegetable matter and its contained nitrogen. The soil of Saskatchewan is a rich loam from 10 to 20 in. in depth, resting upon a chocolate clay subsoil which retains moisture.

Agriculture. Wheat is the principal crop, and the great yields have made Saskatchewan one of the leading wheat producing regions of America; in 1931 the number of acres sown to wheat was 14,775,047. Oats, flax, barley and rye are important crops, and corn for fodder is raised with success. Good natural grasses enable beef cattle to be raised at a low cost. Dairy farming is becoming important; about 27,000,000 lbs. of butter have been produced in one season. There are several large sheep ranches in the southern part of the province.

Manufactures and Cities. The leading industries of the province are flour-milling, dairying, printing and publishing, brewing, and saw-milling. REGINA is the capital and largest city in the province. MOOSE JAW is the center of the wheat belt. SASKATOON is an important trading and educational city, well served

PRINCIPAL FIELD CROPS, SASKATCHEWAN

1930 and Five-Year Average 1925-1929

Crop	Area	Yield Per Acre	Total Yield	Total Value
	acres	bu.	bu.	\$
Wheat 1930	14,326,000	13.7	196,322,000	82,455,000
Av. .. 1925-29	13,456,553	17.7	237,879,660	237,828,400
Oats 1930	4,531,000	27.7	125,509,000	18,826,000
Av. .. 1925-29	4,140,079	28.0	116,000,600	47,657,600
Barley 1930	2,016,000	20.1	40,522,000	4,863,000
Av. .. 1925-29	1,301,308	21.8	28,429,200	14,355,600
Rye 1930	1,010,000	14.7	14,875,000	2,528,000
Av. .. 1925-29	393,851	17.1	6,715,600	5,178,600
Flaxseed .. 1930	431,000	7.0	3,017,000	2,685,000
Av. .. 1925-29	424,102	7.6	3,220,600	5,534,600
Potatoes ... 1930	41,800	cwt. 68.7	2,872,000	2,326,000
Av. .. 1925-29	38,879	67.1	2,609,200	3,269,200
Hay and clover .. 1930	460,900	1.51	696,000	5,742,000
Av. .. 1925-29	317,434	1.53	484,400	4,400,400

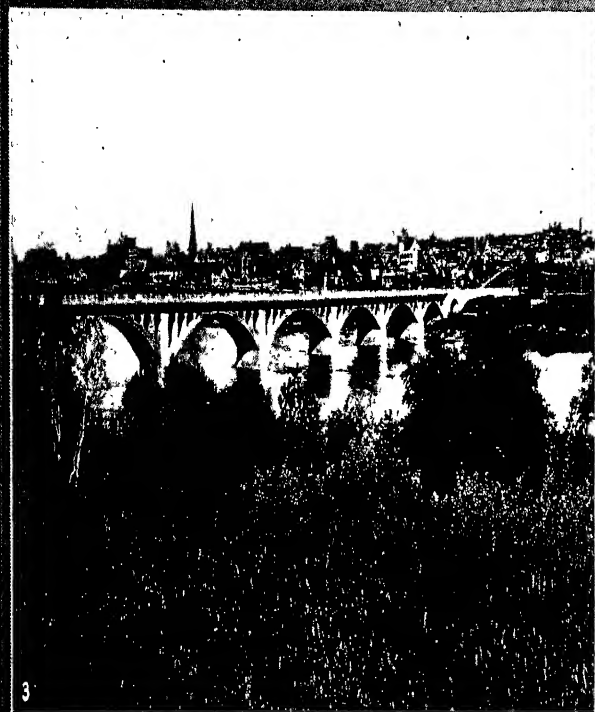
by railways. Prince Albert is in a lumbering and farming region.

Education. The provincial school act provides that any area not exceeding 20 sq. mi. may be organized into a school district provided there are at least 10 children of school age residing there. Each important center has its own high school or collegiate institute. The University of Saskatchewan, founded in 1907, is situated at Saskatoon.

History. In 1905 the Canadian government created the provinces of Saskatchewan and Alberta out of the four provisional districts of Assiniboia, Saskatchewan, Alberta and Athabaska. The Dominion retained all public lands, mines and minerals until 1930, when it was agreed that the province should have control of its natural resources. The name Saskatchewan is a corruption of a Cree Indian expression signifying "swift current" or "rapid water." It was originally applied by the natives to any swift river, but soon became restricted to the chief waterway of this region, later to the territorial division and finally was adopted by the province.

SASKATCHEWAN, a river of Alberta and Saskatchewan provinces, Canada. Two large branches known as the North and South Saskatchewan join near Prince Albert, and flow east into Lake Winnipeg. The north branch rises among the glaciers near Mount Hooker, in 50° 7' N. lat. and 117° 6' W. long.; the south river rises in the north of Montana, and the two flow respectively 770 and 810 mi. before they meet. The length of the united Saskatchewan is 290 mi.

That province derives its name from that of the river, Saskatchewan being an Indian word meaning "rushing water." At the point where the south branch enters the province, its height above sea level is 2,892 ft.; at Saskatoon, 1,440 ft.; and at the confluence below Prince Albert, 1,250 ft. above the sea level. The north branch is at an elevation of 1,689 ft. at Fort Pitt, near its entrance to the province. Between the



1, 4, COURTESY CANADIAN PACIFIC RAILWAYS; 2, 3, CANADIAN NATIONAL RAILWAYS

RURAL AND URBAN LIFE IN SASKATCHEWAN

1. Provincial Parliament Building at Regina. 2. Victoria Square in Regina, capital of the province.
3. Bird's-eye view of Saskatoon on the Saskatchewan River. 4. Field of grain near Regina, part of the vast and productive wheat belt of North America.

confluence of the two branches and the point of debouchment into Lake Winnipeg, the river falls 540 ft. Its principal tributaries, of which the Carrot is the largest, are in Alberta. The main stream passes through Cedar Lake, 30 mi. long, and several smaller lakes. Altogether there are about 1,000 mi. of navigable waterway; steamers ascend the north branch to Edmonton, 950 mi. from Lake Winnipeg.

SASKATCHEWAN, UNIVERSITY OF, at Saskatoon, Sask., Canada, a coeducational and non-sectarian institution established in 1907. Classes in arts and sciences were opened in 1909. Maintenance of the university is partially provided for by assignments of revenue and legislative grants. The library contains 45,000 volumes. In 1931 there were 3,483 students and a faculty of 120 headed by Pres. WALTER C. MURRAY.

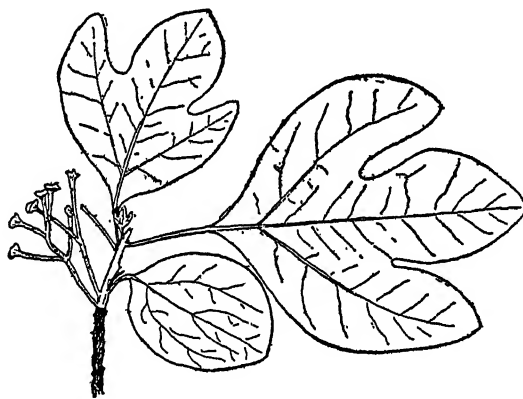
SASKATOON, the second largest city of Saskatchewan, Canada, situated about 150 mi. northwest of Regina, and about 450 mi. northwest of Winnipeg, on the South Saskatchewan River. An important junction of both the Canadian Pacific and Canadian National railroads, and commanding a distributing area of about 48,000 sq. mi. over central Saskatchewan, Saskatoon is a great wheat and manufacturing center. The Dominion Interior grain elevators with capacities for 5,500,000 bu., serve the extensive agricultural interests, and the numerous industries include cereal and flour milling, tractor, brick, road machinery and cement block manufacture and brewing. Saskatoon also has foundries, stockyards and packing houses. Although a mere hamlet in 1900, it to-day is a modern city, substantially built, and supporting excellent public works and utilities, many churches, two hospitals and numerous schools and colleges among which are the University of Saskatchewan and a Provincial agricultural school. Pop. 1921, 25,739; 1931, 43,291.

SASONOV, SERGEI DIMITRIGEVITCH (1866-1927), Russian statesman and Minister of Foreign Affairs, was born July 29, 1866 in the province of Ryazan, and educated at the Alexandrovsky Lyceum, St. Petersburg. In his youth he entertained liberal views, at times writing for the liberal press. From 1890 to 1894 he served as second secretary of the Russian embassy in London and again in 1904-05 as counsellor, rendering excellent service in the absence of Ambassador Benckendorf, in the settlement of the Dogger Bank affair. During his stay in London, he made the acquaintance of the English statesmen with whom he was later to have such important relations. From London he went as Russian minister to the Vatican, whence he was recalled in the summer of 1909 to become assistant secretary of foreign affairs under Isvolsky. He succeeded the latter as foreign minister in 1910, continuing in that office till 1916 when he was forced by ill-health to resign. Next year he was appointed ambassador to England but was recalled on the eve of his departure, just before the overthrow of the czar. After the Bolsheviks seized power he escaped from Russia, and was in Paris during the Peace Conference

where he opposed the recognition of Soviet Russia. In 1920 he retired to private life. He died in Nice, France, on Dec. 23, 1927.

During his conduct of the foreign affairs of Russia, the alliance with France was materially strengthened. The chiefs of staff met regularly and developed fully the plans for mobilization against Germany. In 1913 a naval convention with France was made. The Balkan Alliance of 1912 was consummated under the aggressive participation of Hartwig, the Russian minister at Belgrade, despite the accord reached with Germany on the Bagdad Railway. Assurances of support were asked from France in case Russia pushed her claims at Constantinople. A naval accord with England was made in 1914, while Serbia was given every assurance of Russian support in the fateful negotiations following the assassination of the Archduke Francis Ferdinand at Serajevo. The degree of Sasonov's responsibility for the mobilization of Russia's armies and the extent to which this precipitated the World War is a matter of controversy among historians.

SASSAFRAS (*S. variifolium*), a handsome aromatic tree of the laurel family found in sandy soils from Maine to Michigan and Kansas, southward to Florida and Texas. It grows usually 40 to 59 ft. high with deeply furrowed bark and light green branchlets which bear entire or variously lobed, sometimes mitten-shaped leaves, small yellowish flowers



COURTESY IOWA GEOL. SURV.

and dark blue berries. From the bark of the root, which serves as a mild aromatic stimulant, is obtained the oil of sassafras used for flavoring and in perfumery. The soft, coarse-grained wood, durable in the soil, is employed in making fence posts and rails, light boats and other articles.

SASSARI, a city of Italy, capital of the province of the same name in northern Sardinia, on the railway Chilivani-Porto Torres. The seat of an archbishop, it has a baroque cathedral, Church of Santa Maria di Betlemme, 13th century, city hall, 18th century, with picture gallery, the provincial palace, a university and archeological museum. It engages in

the cultivation of wine, olives and vegetables, in tanning, printing and in trade. The harbor is Porto Torres. Pop. 1931, 53,565.

SATELLITES, the small attendant bodies that revolve around the planets of the solar system. At present 26 are known, viz. one for the EARTH (the MOON), two for MARS, nine each for JUPITER and SATURN, four for URANUS, and one for NEPTUNE.

SATEM-LANGUAGES, a group of INDO-EUROPEAN language characterized by transformation of Indo-European *k* into a sibilant, instead of retaining it as a palatal as in the CENTUM-LANGUAGES. The designation is taken from the AVESTA and LATIN representatives of the Indo-European word **kmtō-m* for **dkm-tō-m*, "hundred," *satem* and *centum* respectively, as Sanskrit *śatām*, Old Church Slavic *sūto*, Lithuanian *šimtas*; but Greek *he-katon*, Gothic *hund*, Old Irish *cét*. The *satem*-group includes Indo-Iranian, Armenian, Illyrian (with Albanian), Baltic and Slavic (see separate articles on these subjects), and is usually regarded as implying either Asiatic origin or a relatively late migration into Europe, the only *centum*-languages thus far known outside Europe being KANISIAN (?) and TOKHARIAN.

SATIN SPAR, a name applied to fibrous forms of Calcite and of Gypsum which show a silky luster, sometimes used as ornamental stones. Commonly, it refers to the gypsum variety which is cut cabochon, or as beads, for use in cheap jewelry. It then shows a chatoyancy, which it rapidly loses because of its softness, wear quickly ruining the polish. The calcite variety is slightly harder.

SATINWOOD, a beautiful ornamental wood with a rich luster used for making fine furniture and in veneering. It is produced by a medium-sized tree (*Chloroxylon Swietenia*) of the mahogany family, found in India and Ceylon. A wood of similar quality, likewise called satinwood, is obtained from *Zanthoxylum flavum*, a small tree of the rue family found in southern Florida and the West Indies. In some parts of the United States the heavy, close-grained timber produced by the sweet gum (*Liquidambar styraciflua*) is known as satinwood.

SATIRE, a kind of writing in verse or prose which ridicules human vices, follies and stupidities, or, in some cases, persons.

Satire, directed against political, social, religious or other institutions, has been written in almost every age; among the Greeks by Archilochus, Hipponax, Simonides of Amorgos, Aristophanes and others (see also FABLE); among the Romans by Lucilius, Persius, Horace, Martial, Juvenal, Lucian, Petronius, etc. The great medieval satires, REYNARD THE FOX and *Till Eulenspiegel*, were succeeded in the 16th century by the more modern satirical writings of Rabelais, Erasmus, Ulrich von Hutten and Mathurin Régnier. French satire reached its height in Voltaire; Spanish in the *Don Quixote* of Cervantes; and German, perhaps, in the poems of Heine. English satire, after the 17th century works of Donne, Marvell, Marston, Hall and Butler, was greatest in the 18th century

under Dryden, Pope, Gay, Arbuthnot and Swift. It was sustained in the 19th by Byron, Thackeray, Butler and Hood and in modern times is perhaps best represented in the plays of G. B. Shaw. Outstanding American satires have been written by Lowell, Irving, Holmes, Bierce, Mark Twain, Finley Peter Dunne ("Mr. Dooley"), H. L. Mencken and Sinclair Lewis.

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SATSOP, a North American Indian tribe, a subgroup of the Chehalis who belong to the Salishan linguistic stock. The Satsop live on a river of the same name in Washington.

SATSUMA, the name of one of the two principal feudal clans in Japan under the last Shogunate. The headquarters of the clan were at Kagoshima, in the south of the southern island of Kyushu. At the time of the Restoration of 1868 the Satsuma clan threw its powerful influence on the side of the emperor and modernization. From the beginning of the modern period, the Satsuma group concerned itself particularly with the Japanese navy while its principal rival, the Choshu group, turned to the Japanese army. For years there was sharp rivalry in the government between the members of these two clans.

SATU MARE, Hungarian Szatmar, a city on the Szamos River in Transylvania, Rumanian since 1921. It is the seat of a Roman Catholic bishop, with theological and other schools, a museum and library. The city has a large plant making railroad cars and a mill. Trade is principally in agricultural products. Founded by Germans before the 12th century, the majority of the inhabitants are now Hungarians. Pop. 1930, 41,674.

SATURATED STEAM. See STEAM.

SATURATION, in chemistry, the condition reached in a solution when the solvent can take up no more of the substance to be dissolved. The term is also used in meteorology and is applied to the atmosphere when it has absorbed as much water vapor as it can contain under the existent conditions.

SATURN or **SATURNUS**, in Roman mythology, the god of agriculture, the same as the Greek CRONOS. The Saturnalia was a yearly festival held in Saturn's honor.

SATURN, the second largest planet of the solar system and the sixth planet in order of distance from the sun. It revolves around the sun in 29½ years at an average distance of 886 million miles, in an orbit slightly elliptical and inclined to the ecliptic at an angle of 2½°. Its distance from the earth varies from about 750 million to more than a billion miles. To the unaided eye it appears as bright as a star of the first magnitude, such as Rigel or Procyon, and shines with a peculiar yellow hue.

Saturn is unique in astronomical experience in that it is surrounded by a ring, flat and circular in shape, composed of an enormous number of very small particles all revolving around the planet. The outer diameter of the ring is about 171,000 miles, the inner diameter about 88,000. The ring approaches to within

about 7,000 miles of the surface of the planet. The whole band, 41,500 miles wide, is divided into three strips. The middle strip is the brightest of the three and is 16,000 miles across. It is separated on the inner side, by a gap 1000 miles wide, from the faint "crape ring," which has a width of 11,500 miles. The outermost ring is about 10,000 miles wide and is separated from the middle ring by "Cassini's division," a gap nearly 3,000 miles across. The ring system is exceedingly thin, actually not more than 10 miles or so thick. When it comes into such a position that it is viewed edgewise from the earth, which happens about every 15 years, it completely disappears from view even through the largest telescopes.

The body of the planet is the shape of a spheroid, much flattened at the poles, by the quick rotation on its axis in 10 hours. The equatorial diameter is 74,000 miles; the polar, only 66,000. Its volume is 734 times, and its weight 95 times greater than that of the earth. Its density is only 0.715 that of water. It has been surmised that the planet is composed of a small core of solid rock surrounded by gaseous layers. The measured temperature at the surface is about 240° below zero.

Saturn possesses 9 satellites; the largest, Titan, slightly exceeds the moon in size, the others are only a few hundred miles in diameter. The innermost, Mimas, is no further than 30,000 miles away from the outer edge of the ring; the average distance of the remotest satellite, Phoebe, is 8 million miles.

W. J. L.

SATURNUS. See SATURN.

SATYR, in Greek mythology, a deity of the woods, the same as the Roman **FAUN**. Satyrs were represented as licentious men with goats' ears, tail and hoofs, though sometimes they had only the ears of a goat. They were companions and attendants of Dionysus. (See **BACCHUS**.) The old ones were known as Sileni, the young ones, Satyrisci. The satyrs were skilled in playing the flute, syrinx and bagpipe, and often pursued nymphs in their revels.



SATYR WITH TORCH
National Museum,
Naples

SAUERBRUCH, ERNST FERDINAND (1875-), German surgeon, of Barmen, Rhenish Prussia. He was professor at Marburg (1907), invented a pneumatic chamber

which was instrumental in advancing the possibilities of intrathoracic surgery, and also devised the positive pressure cabinet in which a patient breathes compressed air while the pleural cavity is opened at ordinary atmospheric pressure. The latter device has greatly aided surgery of the esophagus and the chest.

M. F.

SAUERKRAUT, a food formed by allowing salted **CABBAGE** to undergo natural fermentation. Cabbage is cut into shreds and sprinkled with salt ($2\frac{1}{2}$ lbs. to 100 lbs. of cabbage) while it is being packed into crocks, barrels or vats. The material is weighted

down with boards and stones and allowed to ferment at about 60° - 70° F. for a month or six weeks. During this time certain bacteria occurring on the cabbage multiply in enormous numbers and convert the sugar of the cabbage into lactic acid, acetic acid, ethyl alcohol (see **ETHYL COMPOUNDS**)—about 1.4, 0.4, and 0.5% respectively, and other fermentation products. The quality of sauerkraut depends mainly on conditions of fermentation, such as temperature, kinds of bacteria, etc. The best grade has a translucent, cream-white appearance, a firm, crisp texture, and a pleasant acid taste. Its nutritive value is essentially the same as that of cabbage. Liquid remaining in the vat after removal of the sauerkraut is clarified and sold as sauerkraut juice.

Most of the sauerkraut produced in the United States is marketed as a canned product. It is estimated that between 100 and 150 million cans are produced annually. New York, Wisconsin, and Ohio are three leading producing states.

W. H. P.

SAUGUS, the largest town in Essex Co., north-eastern Massachusetts, situated on the Saugus River, near Boston Harbor, about 10 mi. north of Boston. It is served by bus lines and the Saugus Branch of the Boston and Maine Railroad. The town is a residential community, but has some industrial importance. The annual factory output is about \$700,000. In 1929 the retail business amounted to \$1,919,456. Saugus is a place of romantic charm and historical importance, once the rendezvous of pirates. It has many fine old houses. The town is situated on the old Salem Turnpike, opened in 1803, and Newburyport Turnpike, first traveled in 1805. The site was



FROM MAXIMILIAN VON WIED-NEUWIED'S TRAVELS

SAUK AND FOX INDIANS
From a drawing by Karl Bodmer

settled by white men in 1629, a few years after the murder of Nanepashment, the Sachem of Saugus, whose history is related by John Whittier in the *Bridal of Pennacook*. The settlement in 1637 was named Lynn. Saugus was set off from Lynn and incorporated in 1815. Pop. 1920, 10,874; 1930, 14,700.

SAUK AND FOX, two closely related North American Indian tribes which were united for so long that they are usually spoken of as one tribe. They use a dialect of the Algonkian linguistic stock. They shifted frequently but their best known territory was in southern Wisconsin and northern Illinois. Warriors shaved the head leaving only a standing roach which extended from forehead to nape of the neck like a cock's comb. Though generally considered typically Central Algonkian people, they were strongly influenced by the Plains.

SAUL, the first king of the Hebrews, the son of the Benjaminite Kish, is traditionally believed to have reigned from 1055 to 1033 B.C. The Bible sources of his life are found in I Samuel 10-31, where are described his many wars on the Philistines, Amalekites and other nations near Israel. Some students of the Scriptures hold that the name of the first king of Israel passed into oblivion and that the story of Saul is built on traditions of a clan with his name. The miraculous elements in the narratives, and the story of his visit to the witch of Endor, are all apparently explained by various theories of legend building. As presented in the Bible, Saul is shown as a man of courage and acknowledged patriotism, but the writer allows the stories of his fits of passion, cruelty and melancholy to dominate the total impression made by his life.

SAULT SAINTE MARIE, the county seat of the Algoma District, a port situated between Lake Superior and Lake Huron, in Ontario, Canada. It lies about 500 mi. northwest of Toronto. In a country rich in timber forests, minerals and lake and river waterways, Sault Ste. Marie is given over to industrial and shipping interests. Great steel and paper mills are its chief enterprises, and there also are shipbuilding plants, chemical works and other factories. Hydroelectric power is abundant, electrifying the whole district within a radius of 50 mi. A well-built city, it has a technical school and collegiate institute, churches and many public works and buildings. The site was visited as early as 1622 by Étienne Brule and Grenolle. Sault Ste. Marie was incorporated as a town in 1887, as a city in 1912. Pop. 1920, 21,092; 1931, 23,082.

SAULT SAINTE MARIE, a city of Michigan, in the eastern part of the Upper Peninsula, the county seat of Chippewa Co., situated as a port of entry on St. Mary's River. It is served by three railroads and lake steamers, and has a municipal airport. A railroad bridge and ferries connect it with the opposite city of Sault Ste. Marie, Ont. The St. Mary's Ship Canal is one of the leading highways for marine traffic. Sault Ste. Marie is a shipping point for coal, limestone and some farm and dairy produce. In 1929 its manufactures were worth about \$11,000,000; the value of the retail trade was \$8,948,863. The city is in the midst of a summer resort region, with a climate favorable to hay fever sufferers. Sault Ste. Marie was founded in 1618; it was incorporated in 1887. Pop. 1920, 12,096; 1930, 13,755.

SAULT SAINTE MARIE SHIP CANAL, a waterway constructed on both banks of St. Mary's River which connects Lake Superior and Lake Huron, at the east end of the Upper Michigan Peninsula. The river has a drop of 18 to 20 ft. per mile at Sault Ste. Marie, where navigation in the river proper is barred by islands and numerous rapids. To circumvent the obstructions, in 1797-98 the Northwest Fur Co. built a canal equipped on the Canadian side with a lock, and in 1853-55 the state of Michigan constructed the Soo Ship Canal on the southern side. A second Canadian canal was opened in 1895. The present canal on the American side was largely built after 1882 by the Federal Government. It consists of two waterways with locks around the falls of St. Mary's River, with a total length of 7,515 ft., a width of 80 ft. and a depth of 24½ ft., the system costing \$26,413,737. The one-lock canal on the Canadian side has a length of 1.41 mi., a width of 19 ft., and cost \$6,787,623. The first or Weitzel Lock is 515 ft. long, the second or Poe Lock is 800 ft. long, the third or Davis Lock is 1,350 ft. long, and the fourth or Sabin Lock, completed in 1919, is also 1,350 ft. in length. In 1930 shipping through the canal system totaled 72,897,752 short tons valued at \$760,968,185. Of the total freight, 71,206,424 tons or approximately 97.7% passed through the American canal, 1,691,328 tons or approximately 2.3% through the Canadian canal.

SAUSAGE, finely chopped pork or other meat, highly spiced, and stuffed into casings. Bologna sausage is made of lean beef and fat pork, ground and mixed with salt, pepper, mace or coriander seeds, stuffed into beef casings, smoked, cooked and dried. It is named for Bologna, Italy, where it is thought to have first been made.

Casings of the size used for frankfurters and small sausage links are prepared from hog and sheep intestines; larger casings are from the intestines of cattle. Bladders and stomachs are likewise used as casings. In the preparation of casings, the organs are freed from attached fat or tissue, promptly cooled to prevent spoilage, thoroughly cleaned inside and out, and packed in salt to cure. Owing to the delicate character of casings and also their final use as containers of food products, the process requires great care under strict conditions of sanitation.

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SAUSALITO, a city in Marin Co., western California. It is situated on San Francisco Bay, 6 mi. north of San Francisco and is served by bus lines, ferries and the Northwestern Pacific Railroad. Sausalito is a suburb of San Francisco. The local industries are shipbuilding and alcohol manufacture. Mr. TAMALPAIS and MUIR WOODS lie in the vicinity. The city was incorporated in 1893. Pop. 1920, 2,790; 1930, 3,667.

SAVA. See **SAVE**.

SAVANNA, a city in northwestern Illinois, in Carroll Co., situated on the Mississippi River, 138 mi. west of Chicago. River craft, ferries, bus lines and

two railroads serve the city. There is a bridge to Sabula, Iowa. Savanna is a shipping center for livestock, grain, lumber and dairy products and has railroad yards and shops. Northwest of the city, on the Illinois side of the river, is Mississippi Palisades Park. Savanna was founded in 1828 and incorporated in 1850. Pop. 1920, 5,237; 1930, 5,086.

SAVANNA, in the tropics and sub-tropics, broad open grasslands, dotted with isolated trees. The savanna climate is marked by alternate rainy and dry seasons, favoring a rank growth of grass which the drought cures to natural hay. In parts the great African savanna, surrounding the rainforest, into which it grades, is parklike, with scattered baobabs and other trees; in parts it is dominated by impenetrable growths of giant grasses from 5 to 15 ft. high; elsewhere it is of the bunch-grass savanna type exemplified in the llanos and campos of South America and the downs of Australia.

SAVANNAH, a city port in southeastern Georgia, the county seat of Chatham Co., situated on the Savannah River, 18 mi. from the Atlantic Ocean. Bus and truck lines, trans-Atlantic and coastwise steamships and five railroads serve the city. There is a municipal airport. Savannah is one of the largest exporting ports on the east coast of the United States. The city is a great industrial center, handling cotton, lumber, sugar, cottonseed products and naval stores for export, and manufacturing cottonseed products, turpentine, sugar, rosin, lumber, paints, metal products and fertilizers. In 1929 the factory output was approximately \$14,000,000; the retail trade amounted to \$32,955,271. The vicinity produces cotton, fruit and vegetables.

Gen. James Edward Oglethorpe founded Savannah in 1733. Two years later the Wesley brothers came to Georgia. John Wesley was the third rector of the historic Christ Church, and here established the first Protestant Sunday School in America. George Whitfield was the founder of Bethesda, the first orphanage in America, near Savannah. During the American Revolution many inhabitants of the city were strong loyalists. The scene of much fighting, Savannah was captured by the British in 1778 and was not evacuated until 1782. In 1819 the first steam-propelled vessel, named the *Savannah*, sailed from this city to Liverpool, England. The *John Randolph*, America's first iron ship, was launched at Savannah, July 9, 1834.

The city is beautifully laid out, with broad streets and great live oaks, magnolia trees and palmettoes. Attractive beaches and seaside resorts are near by. Located in the vicinity are the handsome plantations, the Hermitage and Wormsloe, and also Mulberry Grove, where Eli Whitney made the first cotton gin. Savannah has many examples of fine colonial architecture among its residences and public buildings. Pop. 1920, 83,252; 1930, 85,024.

SAVANNAH, BATTLES OF, 1778-79, engagements beginning the Southern campaign of the Revolutionary War, which resulted in British successes. A British force of 3,000 men under Col. Campbell,

sent from New York by sea, landed near Savannah and on Dec. 29, 1778 overpowered the Patriot force of fewer than 1,000 men under Gen. Robert Howe which attempted to defend the city. The British took 500 prisoners, and a large quantity of ammunition and supplies. Early in Sept. 1779, the French fleet under Count Charles D'Estaing arrived before Savannah, and with the aid of a land force under Gen. Lincoln, then in command of the Continental army in the South, beleaguered the city. D'Estaing kept up a haphazard bombardment for three weeks, until the danger of autumnal gales caused him to persuade Lincoln to make a direct assault. On Oct. 9 the combined forces attacked the city, but were repelled with a loss of about 800 men. Count Casimir Pulaski was among the mortalities. The French fleet returned to the West Indies, while the American army was forced to retire to Charleston. In the Civil War, the termination of Gen. Sherman's "march to the sea" was the capture of Savannah, Dec. 25, 1864. The city was defended by a Confederate force of 18,000 under Gen. Hardee; a few miles south was Ft. McAllister, with 21 guns and a garrison of 200. On Dec. 13 Sherman stormed the fort; its garrison was forced to surrender, and Savannah was thereby left vulnerable by sea as well as by land. The Confederate army succeeded in escaping from the city, Dec. 24; Sherman took possession on Christmas Day.

SAVANNAH RIVER, a river of South Carolina and Georgia, rising in the eastern slope of the Blue Ridge Mountains in northwestern South Carolina. The stream flows southeast, forming the boundary line between Georgia and South Carolina and empties into the Atlantic Ocean through Tybee Sound, 18 mi. below Savannah. It crosses the fall line just above Augusta where it affords abundant water power for manufactures. The main stream of the river is 314 mi. long, has a total fall of 577 ft. and drains 11,402 sq. mi. Its chief tributaries are the Broad, Seneca and Tallulah. Steamboats can ascend it to Augusta.

SAVE, or **SAVA**, a river of Yugoslavia, one of the chief tributaries of the Danube having a total length of 500 mi. It has two sources, both rising in the northwest corner of the kingdom in the Triglav Mountains. These two headstreams, the Wurzener Save and the Wocheiner Save, unite at Radmannsdorf to form the Save, which then flows in a southeasterly direction along the boundary line between Carniola and Styria. Passing through Croatia-Slavonia, and by the capital city of Agram, the Save courses southward through old Serbia and joins the Danube at Belgrade. The chief affluents of the Save are the Kupla, Unna, Vrbas, Bosna and Drina. All of these rivers are right bank tributaries of the Save, descending from Croatia, Bosnia and Herzegovina. The Save is navigable to steamers from its mouth at Belgrade to the influx of the Kupla near Sisak, a distance of about 350 mi. The basin to which the river gives its name comprises a territory of about 35,000 sq. mi. The Paris-Constantinople railway follows the Save basin on the way to Belgrade.

SAVINGS BANKS, UNITED STATES. These institutions have evolved, in the Atlantic seaboard states, from charitable institutions into mutual banks, that is, banks without capital stock and dividends, the PROFITS being paid out to the depositors in the form of INTEREST except for enough to form RESERVES and cover expenses. In some of the other states, however, the law is so lax that banks are permitted to call themselves savings banks even when they are run for the profit of the owners. Many commercial banks also have savings departments, where interest-bearing DEPOSITS not subject to CHECK are accepted, but these are not true savings accounts.

During the last half of the 18th century several attempts were made, usually under the auspices of the church, to provide for the savings of the thrifty poor, and to encourage such savings. The first savings bank of a modern type, however, was not organized until 1810, when Duncan's Bank was organized at Ruthwell, Scotland. The Edinburgh Savings Bank was organized in 1814, and in 1816 the Provident Institution for Savings in the Town of Boston inaugurated the movement in the United States. In 1819 a savings bank was organized in New York City.

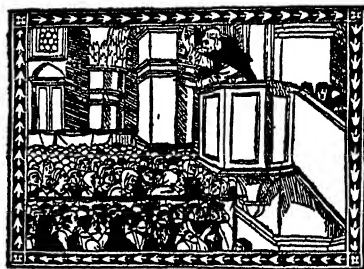
In most states the laws regarding savings banks are more strict than those regulating commercial BANKS, for it is felt that the savings depositor is apt to come from the lower-income classes and to need more protection. Such banks are sometimes limited as to the amount of deposit which may be accepted from any one depositor, and also as to the type of investment which may be made with the funds entrusted to their care. In New York State, which has one of the most advanced mutual savings bank laws, savings banks are restricted to government bonds, mortgage loans, and state and municipal securities issued by communities whose credit is good. Other states permit investment also in railroad bonds, bank stocks, and endorsed promissory notes. In 1910 the United States Government established a postal savings system for the benefit of small depositors who might be unwilling or unable to use the regular savings banks. These accept no accounts of more than \$2,500, and pay only 2% interest.

The economic function of the savings bank is to gather up the scattered small savings of many individuals and by combining them into one large stream, make them available for investment in corporate enterprise. The social function of the savings bank is, however, more important than the economic, for it is the protection of the SAVINGS of the individual and these savings represent security from the needs of old age, illness and unemployment. It is therefore to the interest of society as a whole that savings be adequately protected by law. B. H. B.

SAVONA, a seaport and episcopal see, capital of a province of the same name in Liguria, northwestern Italy, situated about 25 mi. southwest of Genoa, on the Gulf of Genoa. It is the ancient Roman *Savo*. During the Middle Ages Savona rivaled Genoa as a

port. In 1926 the town handled 1,301,070 tons of merchandise. Iron mills and foundries make up the chief industries. Of special interest are the 16th century cathedral and the handsome Della Rovere Palace. Pop. 1931, 60,621.

SAVONAROLA, GIROLAMO (1452-98), a celebrated Italian monk and religious reformer, was born at Ferrara in 1452. He became a Dominican monk at 23 and soon was one of the most noted preachers of his day, denouncing the corruption of the



SAVONAROLA IN THE PULPIT
In "Savonarola's Compendio di Revela-
tione," Florence, 1496

Church and clergy. In 1491 he was chosen prior of the convent of St. Mark, Florence, where he had great influence in reforming the city. With the downfall of the powerful Medici family, Savonarola became a political leader, but was excommunicated by Pope Alexander VI. Popular feeling was soon directed against the monk, and he was arrested, tortured and put to death at Florence in 1498.

SAVOY, HOUSE OF, the oldest reigning family in Europe, a member of which now occupies the Italian throne. Humbert, 1003-56, its founder, acquired Savoy in the extreme northwest of Italy and other territories in France and the Italian peninsula. His son, Odo, obtained Piedmont through his marriage with Adelaide, Countess of Turin. Additional territories, including Montferrat and Nice, were acquired by their successors. The House of Savoy was subsequently allied at times with France and at times with the Holy Roman Empire. By the TREATY OF UTRECHT in 1713 Victor Amadeus II received Sicily, later exchanged for Sardinia, and the title of King. From 1815, when the dominions of Sardinia-Piedmont were restored to Charles Emmanuel IV by the Congress of Berlin, the fortunes of Savoy were linked with those of Italy. From Charles Emmanuel the throne passed to his brother, and then to the House of Carignan, represented by Charles Albert, in 1831. An ardent revolutionist before his accession, Charles Albert was driven to conflict with Austria. He was badly defeated at Novara and Custoza. In 1861 he abdicated in favor of his son, Victor Emmanuel II, grandfather of the present king of Italy.

SAWFISH, a family (*Pristidae*) of large shark-like rays, found in warm seas and along shores, in the West Indies and the Gulf of Mexico. It is noted for the long saw-like prolongation of the snout, extending 2 or 3 ft., with a jagged row of sharp, bony teeth on

each side, while still other teeth are inside the mouth, located on the under side. The sawfish feeds on smaller fishes and attacks a whole school, killing right and left. There are about 5 varieties of sawfish, ranging in length from 9 to 20 ft., resembling the shark in the likeness of the tail and fins and the quality of the scales. The most familiar sawfish (*Pristis pectinatus*) on American shores is greatly disliked by fishermen because of its destruction of their nets.

SAWFLY, a popular name for insects of the family *Tenthredinidae*. In form they are blunter and less wasp-like than most other hymenopterous insects. Also they differ in the formation of their ovipositors. These consist of movable, toothed blades used to cut holes in vegetable tissue preparatory to egg laying. The larvæ are caterpillar-like but always have at least six pairs of prolegs. Many attack cultivated plants. The majority are leaf-feeders, but a few species produce galls, and still others are leaf-miners. The imported, current-worm, the pear-slug, the rose-slug, the raspberry sawfly and the cherry fruit sawfly are among those of greatest economic importance. Control measures consist of poison sprays.

SAWING MACHINES include both circular and BAND SAWS, and can cut wood, metal, stone and other materials. They range from the small circular saw, for "slotting" wood screws, to the large band saws that are run in gangs and that cut the largest trees into lumber. Marble and granite are also sawed into slabs, usually with gangs of reciprocating saws. Saws for stone work are frequently without teeth, the cutting being done by water and sand, steel shot or other ABRASIVES which are fed into the cut ahead of the saw blade. Steel rails and beams are also cut with saws having no teeth (*see also* PARTING METALS), but revolving at such a high speed that the metal actually melts at the point of contact. Saws are also used in cutting up fiber, composition boards and sheet metal. Saws are made with inserted teeth formed of the new cutting ALLOY, tungsten-carbide, which is nearly as hard as diamond. It is very probable that these will be used in stone cutting in the near future.

F. H. C.

SAW-MILL. *See* LUMBERING.

SAWOKLI, a sub-tribe of the Hitchiti, a North American Indian group speaking a dialect of the Muskogean linguistic stock. They lived on the west bank of the Chattahoochee River in Barbour Co., Ala.

SAWS, cutting tools consisting of a strip of metal with small, sharp teeth on one edge, the teeth being alternately "set" or slightly bent to either side to permit clearance for the saw blade. Hand saws are of the straight-blade type, ranging in size from the carpenter's saw to the huge cross-cut saw for felling trees. Power saws comprise steel discs with teeth on the circumference, called *circular* saws; and continuous bands of steel with teeth cut on one edge, called *band* saws. Band saws run over pulleys at high speed and were originally made of narrow bands and used only on small work, but they are now made in very large sizes for the heaviest work. Their main advan-

tage is that, being much thinner than large circular saws, they waste less lumber.

Originally made for cutting wood, saws of all types are now also used for cutting metal (*see also* PARTING METALS; SAWING MACHINES). The small saw for metal, known as a hack saw, is held in a frame, and is sometimes power driven. Cutting speeds are much less for metal than for wood, and higher-grade steels are demanded in metal-cutting saws.

F. H. C.

SAXHORN, a family of brass wind instruments of varying compass perfected about the middle of the 19th century by Adolphe Sax (1791-1865), a Belgian maker of musical instruments from whose hand also issued the popular saxophone. Saxhorns of the upper register are related to the bugle family, those of the lower register to the tuba family. They are used chiefly in military bands. Since the family of saxhorns comprises seven members, all of which have different registers and all of which are transposing instruments with individual peculiarities in the matter of transposition, tabular treatment is necessary in describing them.

Name	Audible Compass	Departure from Written Note
Sopranino Saxhorn	a to e''' flat	minor third higher
Soprano Saxhorn	e to b'' flat	major second lower
Alto Saxhorn	A to e'' flat	major sixth lower
Tenor Saxhorn	E to b' flat	major ninth lower
Bass Saxhorn (in Bb)	B ₁ flat to b' flat	major ninth lower
Bass Saxhorn (in Eb)	E ₂ flat to e' flat	major thirteenth lower
Contrabass Saxhorn	F ₂ to b flat	major sixteenth lower

(For an explanation of the terminology used in the second column *see* OCTAVE.) All these instruments, even the lowest, are written in the treble clef which accounts for the extraordinary discrepancy between the written compass and the audible. As it will be noticed, the sopranino saxhorn sounds a minor third *higher* than the notes written for it, while the remainder sound lower by the intervals listed.

SAXIFRAGE, the common name for a large genus (*Saxifraga*) of mostly perennial herbs of the saxifrage family. When regarded in the customary sense there are nearly 400 species, though some authorities divide these into several genera; about 75 species occur in North America. They are chiefly alpine and subarctic plants found in rocky places very widely throughout the world. Many are suitable for rock gardens and a few are used as border, window or basket ornamentals. They are usually short-stemmed plants with a circle of basal leaves and variously clustered, white, pink, purple or yellow flowers. Among those commonly cultivated are the strawberry geranium (*S. sarmentosa*), native to China and Japan, with numerous white flowers and strawberry-like runners; the London pride (*S. umbrosa*), native to Europe, with pinkish flowers, and the livelong saxifrage (*S. aizoon*), widespread in alpine and arctic regions, with cream colored, purplish-spotted flowers.

SAXO GRAMMATICUS (c. 1150-c. 1208), Danish writer, author of *Gesta Danorum*, a history of the Danes. Little is known of his life. His great

work, written in Latin, consists of 16 volumes. The first nine consist chiefly of legends; the last seven are authentic history covering the period from 950 up to the year 1186. The work contains a wealth of material which would otherwise have been lost. It is the only extant source of the Hamlet legend.

SAXON, OLD, an extinct West GERMANIC dialect, closely akin to Old English or Anglo-Saxon, and spoken by Saxon tribes between the North Sea and the Hartz Mountains, and east of the Rhine as far as the mouth of the Elbe and beyond. It is the earlier stage of the eastern LOW GERMAN dialects, and was spoken until about 1100, after which it is called Middle Low German, becoming Modern Low German after the 15th century. Not sharing in the second, or High German, sound-shift (*see* GRIMM'S LAW) its consonant-system is more like the English than the HIGH GERMAN. The principal document in which it has been transmitted is the *Heliand*, a "gospel harmony" of nearly 6,000 alliterative verses, written about 830. E. Ro.

BIBLIOGRAPHY.—F. Holthausen, *Altsächsisches Elementarbuch*, 2nd ed., 1921; J. H. Gallée, *Altsächsische Grammatik*, 2nd ed., 1910.

SAXONS, a Teutonic people who probably inhabited modern Schleswig and three islands to the west. They were more akin to the ANGLES in language and customs than to the Old Saxons of the Continent. During the 3rd and 4th centuries they engaged in piracy in the North Sea, invaded Gaul and the southeast coast of Britain, and conquered much of northwest Germany. According to Gildas, they were invited into Britain to aid in repelling the Picts and Scots, afterward turning against their British allies. The *Historia Brittonum* states that HENGIST and Horsa, Saxon exiles, taking service with the British king VORTIGERN, afterward sent for the remainder of their people, who conquered the country. During the 6th century the Saxons consolidated their conquest, settling Essex, Wessex and probably Kent. In the 8th century they had formed a powerful state in northern Germany, which Charles the Great reduced only with difficulty in 772-804. The Saxon tribes were then absorbed into the Frankish state and Christianity was imposed upon them.

SAXONY, a free state of Germany, third state in population and fifth in area, covering 5,789 sq. mi. It is bounded on the east, north and west by Prussia, on the west by Bavaria and Thuringia and on the south by Czechoslovakia. The northern section is part of the North German Plain, whence the land rises toward the south to the mountain ranges, including the Erzgebirge (Ore Mountains), which stretch eastward south of Dresden. East of Dresden are the curious formations of the Elbe sandstone mountains called Saxon Switzerland, and the rest of the country is also mountainous. The chief river is the Elbe, the only navigable one, with many small tributaries. The climate is mild. It is warmest in the Elbe Valley at Dresden and coldest in the Erzgebirge.

Among the population of 4,992,320 in 1925, 90.3%

were Protestant, 3.6% Catholic, and 0.5% Jews. The inhabitants in part are mixed with Slavic blood. In Saxon Lausatia there were 22,228 in 1925, whose mother tongue is Wendish, a Slavic language. Four cities have over 100,000 inhabitants: Leipzig, Dresden, Chemnitz and Plauen. There are 96 deputies elected to the Landtag for four years. The constitution corresponds with that of PRUSSIA and the other German states. Leipzig has a famous university and veterinary school, Dresden a technical university, the famous picture gallery, numerous collections and libraries. Both cities are important cultural centers. Agriculture is carried on intensively on the plain, but Saxony is essentially industrial, the chief branches being textiles, composing one-third of the entire German production, metal industry and machines. Trade is important in the above lines, as also in books, of which Leipzig is the center.

History. Conquered by CHARLES THE GREAT in the 8th century, Saxony later passed to the control of German princes and, changing hands many times, emerged as the Electorate of Saxony in the 15th century. It became a leading state of Germany, but lost this position after the THIRTY YEARS' WAR and regained very little of its former prominence until it became a kingdom in 1806 under the rule of Frederick William I. This king, submitting to Napoleon, was rewarded with the Duchy of Warsaw in 1807, but lost this and half of Saxony after the Emperor of the French was defeated at Leipzig six years later. Long opposition to the existing government finally forced the new king, Anthony, to grant reforms in 1831. Saxony allied herself with Austria in the SEVEN WEEKS' WAR and, upon Prussia's victory, had to pay indemnity and join the North German Confederation, 1866. From that time forward the kingdom was largely under the control of Prussia. After the disruption of the German Empire in 1918, a bloodless revolution caused the abdication of King Frederick Augustus III, and the proclamation of a republic.

SAXOPHONE, a musical instrument of fairly recent origin, being the invention of Adolphe Sax (1791-1865) who patented this popular brass reed-instrument in 1840. It generally resembles a brass clarinet in tone quality. While there are actually seven members of the saxophone family, each with a different compass, only five members, the soprano, alto, tenor, baritone, and bass saxophones, are in general usage, while the alto saxophone among these is



COURTESY C. G. CONN

MEZZO-SOPRANO SAXOPHONE

decidedly the most popular; it is also frequently used in the military band. All saxophone parts are written in the treble clef, which accounts for the discrepancy between the audible and written compass of these transposing instruments. For the sake of clarity, these discrepancies are given tabular treatment:

Name	Audible Compass	Written notes are higher by
Soprano (Bb)	a — d''' flat	major second
Alto (Eb)	d — 2'' flat	major sixth
Tenor (Bb)	A — c'' flat	major ninth
Baritone (Eb)	D — a' flat	major thirteenth
Bass (Bb)	A1 — d' flat	major sixteenth

For an explanation of the terminology in the second column see OCTAVE.

SAY, JEAN BAPTISTE LEON (1826-96), French statesman and economist, was born in Paris, June 6, 1826. His criticism of governmental policies in the *Journal des Débats*, of which he was part owner, sent him to the Assembly in 1871; later in the same year he was appointed Prefect of the Seine, and in 1872 became Minister of Finance. His ability in managing French finances and improving the domestic economy during the following years was instrumental in completing the payment to Germany of the war indemnity before it was due. Say became President of the Senate in 1880, was again Finance Minister in 1882, and in 1889 left the Senate for greater activity in the Chamber of Deputies. He was instrumental in securing many economic and fiscal reforms. In 1886 he became a member of the French Academy. He died in Paris, Apr. 21, 1896.

SAYRE, a borough in Bradford Co., situated near the northwestern boundary of Pennsylvania, on the Susquehanna River, near the mouth of the Chemung River, 17 mi. southeast of Elmira, N.Y. Bus lines and the Lehigh Valley Railroad afford transportation. Sayre is one of a group of four places, including Athens and South Waverly, Pa., and Waverly, N.Y., which form an important industrial community, covering a good sized area. The borough has clothing factories, locomotive and machine shops, foundries, commercial green houses and various other industrial establishments. Sayre was founded in 1880; incorporated in 1891. Pop. 1920, 8,078; 1930, 7,902.

SAYREVILLE, a borough of Middlesex Co., N.J., located on the Raritan River, 7 mi. west of New Brunswick and 6 mi. east of Perth Amboy, N.J. It is served by connections with the Raritan River, New York and Long Branch, and Camden and Amboy railroads. It is the center of a district rich in deposits of sand and clay and is prominent for its manufacturing of bricks, ceramics and explosives. It became a borough in 1919. Pop. 1920, 7,181; 1930, 8,658.

SCABIES, commonly known as "the itch" and "seven year itch," is caused by a mite *Sarcoptes scabiei*. The mite burrows into the skin, and lives in the burrows. The parts of the skin most often attacked are the wrists, backs of the fingers, skin between the fingers, the abdomen and armpits.

The female mite lays her eggs in the burrows. When the eggs develop, the young mites begin independent burrows. The burrows can sometimes be seen as fine black lines, about a quarter of an inch long.

The chief symptom is severe itching, particularly after going to bed. Scratching causes irritation and inflammation of the skin, sometimes with infection and a pustular eruption.

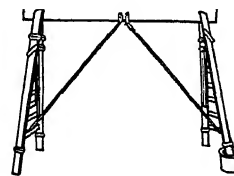
The mite is transferred from person to person through intimate contact, or by sleeping in infected bedding or wearing infected clothing. It is, therefore, apt to be present in more than one member of a family.

Sulphur ointment is most effective in treatment of the scabies, but it must be thoroughly applied, following a hot bath and opening up the burrows by scrubbing. All clothing and bedding should be sterilized by boiling. See also PARASITIC DISEASES. W. I. F.

SCABIOUS, SWEET (*Scabiosa atropurpurea*), a popular garden annual of the teasel family, known also as mourning bride. It is a native of southern Europe, widely cultivated in numerous varieties and sparingly naturalized in California. The branching stems, about 2 ft. high, bear much-divided leaves and dark purple, rose-colored or white flowers in long-stalked heads. The daisy fleabane (*Erigeron annuus*), widespread as a weed, is also called sweet scabious.

SCAFELL, a mountain of England, in Cumberland. It has four main summits, the loftiest of which is Scafell Pike, 3,210 ft. high, the highest point in England. The other summits are Scafell, 3,162 ft.; Great End, 2,984 ft.; and Lingmell, 2,649 ft. On the east side of the mountain rises the River Esk.

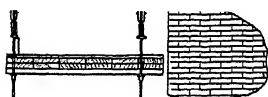
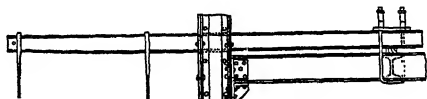
SCAFFOLDS are temporary frames and platforms, either supported from below or suspended at convenient heights, to afford easy access to the work of construction. There are several types of scaffolds, such as "horse," adjustable, built-up, swinging, suspended, "outrigger," and iron workers scaffolds. For work which can be performed within the building, the horse scaffold is commonly used. The height of the standard horse used in building work is four feet. Planks span from horse to horse for platform purposes. Horse scaffolds may be built-up by placing one horse on top of one platform built on the other but, for safety, should not be made more than three horses high.



BUILDERS' HORSE
Boards placed across two of these horses form a scaffold

When scaffolds for interior work are required of more than 14 feet high, special "built-up" scaffolds are used. For work which must be performed from the outside of high buildings, a suspended scaffold is ordinarily used. This consists of a plank platform about five feet wide supported every eight or ten feet by means of steel cables extending up to structural

steel outriggers supported on one of the upper floors. The steel cables are connected at the platform level to hoisting drums, making it possible to raise the platform as the work requires. G. A. H.



COURTESY STEELFORM CONTRACTING CO.
SUSPENDED SCAFFOLD OF THE TYPE USED IN THE CONSTRUCTION
OF TALL BUILDINGS

SCALAR QUANTITIES. In physics two kinds of quantities are dealt with: those which merely indicate the magnitude of a quantity; and those which possess both magnitude and direction.

Examples of the first kind are found in quantities like bushels of wheat, kilograms of mass and seconds of time. They are merely magnitudes and are called scalar quantities.

Magnitudes of the second kind involve the necessity of indicating a direction as well as a magnitude. Thus, it makes a great deal of difference whether a **FORCE** acts, e.g., east or west, or up or down. It is important in what direction a **VELOCITY** takes place. Forces, velocities and **Torques** are illustrations of the so-called *vector quantities*, i.e., those involving both magnitude and direction. Thus a boat sailing with a velocity of 10 knots per hour, northeast, has its velocity specifically indicated as to magnitude and direction.

S. R. W.

SCALAWAGS, a derisive epithet, in the **RECONSTRUCTION ERA**, for southern white men who became Republicans in the hope of sharing offices and other political spoils with the Negroes and **CARPET-BAGGERS**.

SCALE, BARK-LOUSE, or **SCALE-BUG**, any member of an extensive family (*Coccidae*) of small sucking insects, so designated because of their protective coverings. Characteristically the males have a complete metamorphosis (egg, nymph, chrysalis, adult). When mature they are two-winged creatures incapable of procuring food, their mouth parts being replaced by

a second pair of eyes. The females have an incomplete metamorphosis, lacking the chrysalis stage. They are wingless, grub-like and covered as they develop with a protective waxy scale, or a powdery or cottony secretion. Beneath this they pass their lives and lay their eggs or bear living young, for some species are viviparous. When the eggs hatch, the nymphs crawl to new feeding locations where they become stationary.

All scale insects suck the sap of plants. Among them are a few species from which are made useful substances, such as lac-dye, cochineal, shellac and china wax. With such exceptions the species include some of the worst pests with which horticulture has to deal. They or their eggs are so readily transported that some kinds have now world wide distribution. Among the general feeding species are San Jose scale, scurfy scale, oyster shell scale and terrapin scale. Others confine themselves to specific host plants; for instance, pine, cherry, rose, maple, olive, plum and citrus fruits.

Scale insects are destroyed by fumigation of individual trees under tents with hydrocyanic acid gas; by spraying with lime-sulphur solution during winter and by milder contact insecticides when the nymphs first appear. Parasitic and predaceous enemies of some species have been introduced with satisfactory results. See **LADYBIRD BEETLE**. M. G. K.

SCALES, AUTOMATIC. See **WEIGHING MACHINES**.

SCALES, MUSICAL. See **MUSICAL SCALES**.

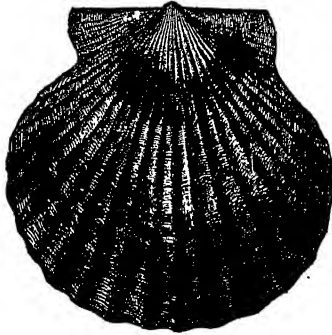
SCALIGER, JOSEPH JUSTUS (1540-1609), French classical scholar, was born at Agen, France, Aug. 5, 1540, son of Julius Caesar Scaliger. He attended the College of Guienne at Bordeaux and the University of Paris. During the course of extensive traveling in Italy, England and Scotland he became converted to Protestantism. His *Manilius*, 1519, *De emendatione temporum*, 1583, and *Thesaurus temporum*, 1606, revolutionized ancient chronology, and in his editions of the *Catalecta*, 1575, of Festus, 1575, and of Catullus, Tibullus and Propertius, 1577, he instituted a new era in textual criticism. Scaliger was a professor at Leyden from 1593 until his death at Leyden, Jan. 21, 1609.

SCALIGER, JULIUS CAESAR (1484-1558), Italian scholar and philosopher, was born near Lago di Garda, Apr. 23, 1484. He spent most of his life at Agen, France, where he attained fame as one of the most eminent scientists and literary figures of his age. His chief philosophical work is the *Exercitationes*, published in 1557, on Jerome Cardan's *De subtilitate*. A comprehensive work, it was praised by G. W. von Leibnitz as best exhibiting the physics and metaphysics of **ARISTOTLE**. Scaliger died at Agen, Oct. 21, 1558.

SCALLOP, the common name for bivalve mollusks of the genus *Pecten*. There are many species, found in every sea in water from 30 to 6,500 feet deep. Their shells are somewhat round, with scalloped edges, and are handsomely marked with radiating ribs or striations. At the hinged end, where the main body of the

shell is pointed, there are two projecting wings. The two valves, or halves, are not quite alike, as the lower one is flatter than the upper, and is notched. Two rows of well-developed eyes border the edge of the mantle. The strong muscle is placed near the middle of the body and this is the edible part of the scallop.

The common American scallop (*Pecten irradians*) is found on the Atlantic coast and in the Gulf of Mexico. Its shell is nearly three inches long, and the eyes on the mantle are bright blue. Scallops usually



COMMON SCALLOP

rest on the bottom of the sea, anchored by a bunch of gluey threads, the byssus, secreted by the foot, but when they are in danger many of them can swim away by flapping their valves. Unfortunately they cannot steer very well, so they often swim in a circle.

In 1929 the total commercial catch of scallops in United States waters amounted to 6,632,000 lbs., valued at \$1,611,000 taken chiefly along the coasts of New England and the middle Atlantic States.

SCALPING, the custom of removing the scalp or a portion of it from the head of an enemy as a trophy. In North America the practice was originally restricted to territory occupied by the Iroquois and Muskogean Indian tribes and their neighbors in eastern United States and the lower St. Lawrence region and in South America to a small area in the Gran Chaco country.

A circular cut about 4 inches in diameter was made just back of the crown of the head and the hair and scalp removed by a good yank. This section of the scalp was usually stretched to a diameter of six inches and dried. Thereafter it appeared in the tribal "scalp dance," as part of the tribal medicine or as decoration of the person or trappings of its possessor. Originally scalps were removed only from dead victims but the Plains Indians frequently scalped their victims alive, an excruciatingly painful process, not necessarily fatal.

Though generally regarded as a peculiarly New World custom, scalping was also known in the Old World.

SCAMMONY (*Convolvulus Scammonia*), a trailing vine of the morning-glory family closely allied to the jalap. From the juice of the thick root is obtained a powerful drug, known also as scammony, used in medicine as a cathartic and anthelmintic.

SCANDINAVIAN DRAMA. The beginnings of Scandinavian drama may be found in the so-called dance ballads performed by bands of strolling players in Denmark in the 15th century. These were ballads sung or recited to the accompaniment of dances illustrating the action of the story. Drama, in the true sense of the word, appears to have developed first in Sweden during the 17th century, when the comedy, *Tisbe*, by Magnus Olai Asterophorus (d. 1647) was performed in 1610. Other Swedish dramatists of this period were Johannes Messenius (1579-1636), Georg Stjernhjelm (1598-1672) and Urban Hjärne (1641-1724).

The first world figure in Scandinavian drama was LUDWIG HOLBERG (1684-1754), whose comedies, satirizing the foibles of his own time, are still read and performed. The first theater devoted to Danish drama was opened in Copenhagen in 1722, and the first Danish play performed in it was Holberg's *Den Politiske Kandestöber* ("The Pewterer Politician"). Other comedies from his pen followed in rapid succession. Holberg's comedies belong to Norway as well as to Denmark, for not only were Denmark and Norway then united under one king, but Holberg was a Norwegian by birth. After Holberg, native drama languished for a time in Denmark while French tragedy and French musical drama held the stage. Musical drama in the vernacular was introduced by Nils Krog Bredal, whose *Gram and Signe* was produced in 1756. Bredal afterwards became a theater director in Copenhagen. Other dramatists of this time were JOHANNES EWALD, Johan Nordal Brun and Johan Herman Wessel. The latter gave the death blow to transplanted French tragedy with his parody, *Love Without Stockings*. The next great figure in Danish drama is ADAM GOTTLÖB OEHELENSCHLÄGER (1779-1850), who found his themes chiefly in the history and mythology of the North. JOHAN LUDVIG HEIBERG (1791-1860) was a distinguished Danish dramatist and critic.

Norway's two greatest dramatists are HENRIK IBSEN (1828-1906) and BJÖRNSTJERNE BJÖRNSON (1832-1910). Ibsen devoted himself almost exclusively to drama, while Björnson was, in addition to being a dramatist, a novelist, poet and political leader. Both began their dramatic work with historical dramas, and both eventually turned to plays dealing with social problems. In Sweden a third great Scandinavian dramatist arose in AUGUST STRINDBERG (1849-1912). Strindberg was a novelist also, but his fame rests on his plays which, like those of Ibsen, have become a part of the great dramatic literature of the world. Several of Ibsen's and Björnson's contemporary Norwegian novelists, notably Jonas Lie, Alexander Kielland and Arne Garborg, wrote plays, as did also the later novelists, KNUT HAMSN and HANS E. KINCK. Another important Norwegian dramatist is Gunnar Heiberg (1857-1929), who wrote bitter social satires. Hjalmar Bergström (1868-1914) was a Danish dramatist of iconoclastic tendencies. Helge Rode (1870-) is a Danish dramatist who has produced tragedies, comedies and social satires. Gustav Wied (1858-

SCANDINAVIAN EVANGELICAL CHURCHES—SCARLATTI

1914), another Dane, wrote several plays, but is best known as a novelist. Recent Swedish dramatists of note have been HJALMAR BERGMAN (1883-), and Ernst Didring (1868-). Oskar Braaten (1881-), is a Norwegian dramatist who has written social dramas often dealing with life in the slums of Oslo.

I. A.

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SCANDINAVIAN EVANGELICAL CHURCHES in the United States are classified separately by the United States Census Bureau as: (1) the Swedish Evangelical Mission Covenant of America, (2) the Swedish Evangelical Free Church, and (3) the Norwegian-Danish Free Church, all of which represent a movement away from the State or Lutheran churches of Denmark, Norway and Sweden. The Swedish Evangelical Mission Covenant of America, formed in 1885, is strongly evangelical in doctrine and congregational in policy. It makes the Bible the sole guide to faith, and has a membership of about 40,000 in about 400 churches. The chief centers of the denomination are to be found in Minnesota, Illinois, California, Iowa, Nebraska and Massachusetts, all of which states have large Swedish populations. Home mission work is carried on in several other states, and foreign missions are conducted in China and among the Indians and Eskimos of Alaska. The Swedish Evangelical Free Church branched from the Swedish Evangelical Mission Covenant and represents about 100 congregations with a membership of approximately 10,000, chiefly located in Minnesota, Nebraska and Illinois. This Church has no written confession of faith and, while receiving the Bible as the rule of faith and practice, leaves its ministers free to follow their own convictions on such matters as baptism, the doctrine of the atonement and the eucharist. The local congregations are self-governing, and conversion and the leading of a holy life are the only qualifications for membership. The Norwegian-Danish Free Church traces its origin to the evangelical spiritual revival which swept Norway early in the last century, leading to the formation of free congregations distinct from the State churches. Many of its members when they first arrived in the United States joined the Congregational churches, with which they were in close sympathy, but in 1910, the Norwegian-Danish Free Church was officially formed. The group represented in 1931 less than 50 churches with less than 5,000 members, these being organized chiefly in Wisconsin, Illinois, New York and Minnesota.

SCANDINAVIAN LITERATURE, a general title for the literatures of Norway, Sweden, Denmark and Iceland. See **DANO-NORWEGIAN LITERATURE**; **ICELANDIC LITERATURE** and **SWEDISH LITERATURE**.

SCANDIUM, a metallic chemical element very similar in properties to the **RARE EARTHS**, though, strictly speaking, not belonging to the group. Its

chemical symbol is Sc, its atomic weight 45.1. It was discovered in 1879 by Nilson, and occurs in nature often with tin and tungsten.

SCAPA FLOW, a stretch of English sea almost surrounded by the Orkney Islands. It is bounded by Pomona, Burray, South Ronaldshay Walls and Hoy islands.

In the World War Scapa Flow gained wide attention when it was selected by Great Britain as the chief base for the British fleet. Upon the close of the war the surrendered German fleet was interned to Scapa Flow and there scuttled. Except for occasional visits by the British fleet and salvaging work, Scapa Flow is now as quiet as in the days before the war.

SCARAB BEETLE (*Scarabæus sacer*), a dark-colored dung beetle of the coleopterous family *Scarabæidae*, common in Mediterranean countries, particularly Egypt. It has been an object of veneration to the Egyptians in nearly all periods of their history. They believed that the male reproduced himself, no female of the species existing; thus it became the emblem of all self-begotten deities. It was also regarded as a symbol of resurrection and immortality, the beetle emerging from the egg and flying heavenwards, as the soul emerges from the mummy. Carved scarabaei, called "scarabs," with various inscriptions, were worn by the living and buried with the dead.

SCARAMOUCHE, the French form of Scaramuccia, popular minor character in old Italian comedy. Originally derived from Spain and obviously caricaturing the Spanish don, Scaramouche is a blustering, comic soldier, dressed usually from head to foot in black. Tiberio Fiorelli (1608-96) introduced him into France.

SCARBOROUGH, a municipal borough and resort in the North Riding of Yorkshire, England, situated upon the shores of a bold peninsula dividing the north and south bays, 231 mi. north of London. Once a strategic Roman station founded upon the site of an earlier settlement, it was destroyed by Norwegians in the 11th century. The ruins of the Norman castle were further damaged during the World War. The old section of the town with its steep, quaint streets, boasts St. Mary's Church in which Norman and Early English features are traceable. The resort, dating from 1620 when mineral springs were discovered, is a brilliant place of large hotels, beautiful cliff gardens and a ravine park. The harbor, dry at low tide, is undergoing improvement. Scarborough to-day depends for its revenue largely upon the tourists and holiday seekers who are further attracted by a sports festival held annually. Pop. 1921, 46,179; 1931, 41,791.

SCARIFIER. See **ROAD MACHINERY**.

SCARLATTI, ALESSANDRO (c. 1659-1725), Italian music composer, was born at Trapani, Sicily, about 1659. The founder of the Neapolitan school of musicians, he holds a secure place in the history of **ITALIAN MUSIC**. He numbered many future composers and teachers of note among his pupils, among whom were Durante, Hasse, and Porpora. In 1709 he

became maestro di cappella at the royal chapel in Naples. Of his 115 operas few have been preserved and the same fate has overtaken most of his 200 masses, but nevertheless Scarlatti contributed importantly to the development of music, particularly in the fields of melodic balance and chromatic harmony. He died at Naples, Oct. 24, 1725.

SCARLATTI, DOMENICO GIROLAMO (1684-1757), Italian composer and harpsichordist, was born at Naples, Oct. 26, 1684, the son of ALESSANDRO SCARLATTI. In 1709 he competed with Handel on the harpsichord, achieving renown as the foremost executant of the day. The same year he became court composer to Queen Marie Casimire of Poland, in 1715 maestro di cappella of St. Peter's, Rome, and in 1721 was attached to the court at Lisbon. His sixty or more harpsichord sonatas, marked by such technical characteristics as repeated notes, wide leaps, and runs in thirds and sixths, were influential in developing the modern technic of the pianoforte. His compositions, in addition to the sonatas aforementioned, include operas and a Stabat Mater for ten voices and organ. He died at Naples in 1757.

SCARLET FEVER, or SCARLATINA, an acute infectious disease said to be caused by the hemolytic *Streptococcus scarlatinae*. This germ grows in the throat, producing a poison which is absorbed into the blood, causing the symptoms of scarlet fever, including the rash.

The infection enters the body through the mouth and nose, usually transmitted by the mucous secretions of other infected persons. Mild and undiagnosed cases are the main factors in the spread of the disease. It is likely that carriers (*see* CARRIERS OF DISEASE) exist. The disease is also carried by infected milk.

One attack of scarlet fever usually protects for life against further attacks.

The disease begins with fever, sore throat, and, as a rule, with vomiting. The temperature rises rapidly to 103° or 104° F. The pulse is rapid, the skin dry and the face flushed. The rash begins twenty-four to thirty-six hours after the onset of the disease. It is a vivid, scarlet eruption, made up of red spots with general redness of the entire skin. The face is flushed, while the mouth and nose are pale, giving the so-called circumoral pallor. During the early stage, the tongue is furred in the center, with little red spots projecting, and red at the edges. This is called the strawberry tongue. The furring or coating clears on the third or fourth day, leaving the tongue surface red and raw, called the raspberry tongue.

The rash begins to fade about the fifth day and convalescence occurs from the sixth to the eighth day. As the rash subsides, the skin is stained and rough. Peeling follows and may persist for weeks.

Among the most important complications are nephritis, that occurs in about 5% of the cases; infection of the middle ear, especially in children; inflammation of the joints; infection of the lymph glands in the neck; and heart complications. (*See also* PERICARDIUM, DISEASES OF.)

During the past half century the incidence of scarlet fever has been lowered and the cases have become much milder. Its mortality is about that of measles, generally not exceeding 3%, and is highest during infancy.

In 1924-1925 the organism which is believed to cause scarlet fever was identified by Drs. George F. and Gladys H. Dick. Antitoxins have been produced, which have been found helpful in treatment. Reports of successful immunization against the disease have also been made. By means of the Dick test it is possible to tell what children are susceptible to the disease. A minute amount of toxin is injected into the skin. If the child is susceptible to scarlet fever, a red spot occurs on the skin around the point of inoculation.

Patients with scarlet fever must be isolated. During the stage of fever, the diet should consist of milk, eggs, and custard. When the temperature is normal, bread and butter and fruit may be added. Antiseptic sprays may be used in the throat. Complications may be treated as they occur. W. I. F.

SCARLET LETTER, THE, a novel of early New England Puritanism, by NATHANIEL HAWTHORNE; published 1850. Hester Prynne, sent by her aged husband, Roger Chillingworth, from the Continent to the Puritan settlement at Boston, falls deeply in love with Arthur Dimmesdale, a young minister, and has by him a child, Pearl, a sin for which she is pilloried by the indignant community and condemned to wear upon her breast a scarlet letter A (Adulteress). The embittered Roger, now arrived in Boston, demands of Hester that she name her lover; but this she consistently refuses to do. At last, Dimmesdale, heckled by Roger and tortured by his own conscience, publicly confesses his sin, and dies in Hester's arms. The book is full of Hawthorne's brooding symbolism.

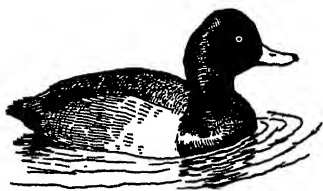
SCARPANTO. *See* KARPATOS.

SCARRON, PAUL (1610-60), French comic poet and dramatist, was born in Paris and baptized on July 4, 1610. While still under 30 he became hopelessly crippled, suffering continual pain which he endured with the greatest courage. In 1643 he published his *Recueil de quelques vers burlesques*, a volume of comic poems, later turning to comic plays, of which the most successful was *Jodelet*, produced in 1645. He also wrote several novels. His wit, his sufferings and the fortitude with which he bore them, brought him a wide circle of friends. In 1652 the poet married Françoise d'Aubigné, later famous as MADAME DE MAINTENON and the secret wife of Louis XIV. Scarron died in Paris, Oct. 6, 1660.

SCARSDALE, a residential suburb, situated 19 mi. northeast of New York City, in Westchester county, southeastern New York. It is served by two railroads. There are many handsome homes in and around this village, which is on the White Plains Post Road. Scarsdale was founded in 1701; incorporated in 1915. Pop. 1920, 3,506; 1930, 9,690.

SCAUP, the name given to two species of diving ducks closely allied to the canvasback and redhead.

The greater scaup (*Nyroca marila*) is found from western Europe to Kamchatka and throughout North America, breeding in the northern parts of its range. It is about 18 in. long and its bill is broader at the tip than at the base. The plumage of the male is finely waved with black and white above and white below, with the head and neck mostly black. The greater scaup is gregarious, assembling in huge rafts,



DRAWING BY GEORGE MIKSCH SUTTON
GREATER SCAUP

and feeds chiefly on shellfish, crustaceans and aquatic plants which it secures by diving. It nests on the ground near water, laying 6 to 10 olive-buff eggs. Although it is usually silent, it sometimes utters a purring note or a harsh scaup. The lesser scaup (*N. affinis*), a similar but smaller species, is also found widely in North America.

SCAVENGER. See REFUSE DISPOSAL.

SCENARIO, an outline form of a play, motion picture or musical comedy which gives the plot elements, descriptions and appearances of characters and all other data necessary for working out the production. The term did not come into wide use until motion pictures became popular. In this connection it refers to a form in which the scene and action of the plot are described in separate units or sequences, which are defined by technical directions for photography, as "long shot," "close-up," "fade-out" and the like. Use of a scenario makes it possible to photograph at the same time all scenes employing the same character or background regardless of their position in the finished production. See also MOTION PICTURES.

SCEPTICISM, in philosophy, a position of doubt as to the ability of the human mind to acquire knowledge. The difficulty may be due either to the incapacity of reason or the inability of the senses to know truth. The former is called idealistic, the latter sensationalistic scepticism.

Pyrrhonism is a form of idealistic scepticism. Because the doctors were not agreed among themselves, Pyrrho (c. 365 B.C.), a contemporary of Aristotle, argued that, since opposite conclusions could be arrived at by reason, reason could prove anything and was therefore not to be trusted. Sensationalistic scepticism has never been better formulated than in the period of the Middle Academy. The senses were held to be unreliable because of (1) the difference in organization of sensible beings; (2) the difference in organization of human beings; (3) the differences in the different senses of the same individual; (4) dif-

ference in circumstances making different impressions in the same individual; (5) uncertainty resulting from the distance and position of objects; (6) the impurity of sensations; (7) the effect of differences of quality upon quantity; (8) the fact that we perceive only phenomena and relations, not the things themselves; (9) the influence of habit.

Among modern sceptics DAVID HUME is best known. He admitted that he could not rationally justify ideas assumed in practical living. It was Hume's scepticism that roused IMMANUEL KANT from his dogmaticism.

SCHACHT, HJALMAR (1877-), German economist and financier, born near Flensburg, Jan. 22, 1877. From 1903-16 he was deputy director of the Dresden Bank, and for the next seven years was on the board of the National Bank für Deutschland. In December, 1927 he became president of the Reichsbank, resigning in April, 1930. He made a tour of the United States in October, 1930, lecturing on the economic problems of Germany. He has represented Germany in international economic conferences and is the founder of the Gold Bank of issue.

SCHAEFER METHOD OF ARTIFICIAL RESPIRATION. See RESPIRATION, ARTIFICIAL.

SCHAFF, PHILIP (1819-93), church historian and theologian, was born at Chur, Switzerland, Jan. 1, 1819. He was graduated at the University of Berlin, in 1841, and three years later emigrated to the United States. From 1844 to 1863, he was professor at the theological seminary of the German Reformed Church at Mercersburg, Pa. In 1870, he became a member of the faculty of Union Theological Seminary, New York. He is chiefly remembered as the president of the American Committee for the revision of the King James version of the Bible. He wrote among other works, *History of the Christian Church* (1882-88), *The Bible Dictionary* (1880), and edited the *Schaff-Herzog Religious Encyclopedia* (1882-87). He died at New York, Oct. 20, 1893.

SCHAFFHAUSEN, a city of Switzerland, capital of the canton of the same name, situated on the Rhine. It is a picturesque medieval city with stone gables and painted façades. The minster, a Romanesque basilica which was once an abbey church, the Rathaus, and the massive tower, which dominates the city, are noteworthy. Industries include the manufacture of textiles, watches, physical and mathematical instruments, earthenware and other commodities. Schaffhausen was a free imperial city until 1501. Pop. 1930, 21,160.

SCHANDORPH, SOPHUS CHRISTIAN FREDERIK (1836-1901), Danish novelist, was born at Ringsted, May 8, 1836. His tales and novels of peasant life were strongly realistic in tone. Among his works are *Common People*, *The Great Mademoiselle*, *Poet and Junker* and several collections of short stories. He died at Copenhagen, Jan. 1, 1901.

SCHARLIEB, DAME MARY ANN DACOMB (1845-), British surgeon, born in London, June 18, 1845. She entered medical college at Madras from which she received a diploma in 1878, and subse-

quently studied at the London School of Medicine for Women. In 1888 she received her London M.D., and was surgeon at the New Hospital for Women, 1887-1902, being appointed senior surgeon in 1889. She was a member of the Royal Commission on Venereal Diseases. She was made Commander of the Order of the British Empire in 1917 and created Dame Commander of the British Empire in 1926. Dr. Scharlieb wrote a number of volumes on medical topics; her *Reminiscences* appeared in 1924. M. F.

SCHAUMBURG-LIPPE, a free state in north-western Germany, bounded by Hesse-Nassau, Westphalia and Hanover. Most of the surface is flat, only the southern part being hilly. The climate is mild and moist, the forests mostly oaks and beeches. The area is 131 sq. mi. A third of the inhabitants engages in agriculture and forestry and 42.7% in industry and trades, the coal mines of the Buckeberg being very productive. The Landtag has 15 members. Of the population of 48,046 in 1925, 98.15% were Protestant.

SCHECHTER, SOLOMON (1850-1915), Jewish theologian, was born in Rumania on Dec. 7, 1850. He studied in Austrian and German institutions of higher learning, and in 1882 settled in England. In 1890 he was appointed lecturer in rabbinics at the University of Cambridge. In 1896 he discovered a portion of the lost Hebrew text of Ecclesiasticus, and in search of other lost literary treasures he went to Cairo, whence he brought to England and America a large portion of the *Genizah* of Fostat. In 1901 he settled in New York where he assumed the presidency of the Jewish Theological Seminary of America, an office which he held until his death on Nov. 19, 1915. Among his best known publications are three volumes of *Studies in Judaism, Some Aspects of Rabbinic Theology, Seminary Addresses and other Papers, The Wisdom of Ben Sira, Documents of Jewish Sectaries*. He was one of the editors of the Jewish Publication Society Bible which appeared in 1917; of the *Jewish Quarterly Review*, and many contributions from his prolific pen appeared in numerous periodical and encyclopaedic publications. J. Bl.

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SCHEELE, KARL WILHELM (1742-86), Swedish chemist, was born in Stralsund, then part of Sweden, Dec. 19, 1742. He first studied chemistry and pharmacy, went to Upsala in 1770, and was elected to the Swedish Academy in 1775, but in the same year withdrew to a small town Koping, where he spent the remainder of his life as an apothecary, living mostly in abject poverty. He discovered the elements chlorine and oxygen, the latter of which quite independently, and probably earlier than Priestley. He analyzed many minerals and organic compounds, and isolated molybdic and tungstic acids, many arsenic, barium, manganese, silicon, and aluminum compounds, and the very important substance sulphuretted hydrogen. He died at Koping, May 21, 1786.

SCHEELITE, an ORE of tungsten, a mineral which varies from transparent to translucent, and in

color from white, through yellow, to brown, red, and green. It is found in vein deposits associated with CASSITERITE, TOPAZ, APATITE, MOLYBDENITE, GOLD, and WOLFRAMITE, in some metamorphic limestones, and PLACERS. Scheelite is a calcium tungstate, crystallizing in the TETRAGONAL SYSTEM.

The only important deposits are in the United States, in California and Nevada. There are minor occurrences in Germany, England, Australia, New Zealand, and Mexico.

Tungsten is of great importance in making incandescent light filaments and high speed tool steels. See also ORE DEPOSITS; METAMORPHISM.

SCHEFFEL, JOSEPH VIKTOR VON (1826-86), German poet and novelist, was born at Karlsruhe, Feb. 16, 1826. Modeling his poetry and fiction after Scott, he produced his two most famous works: *The Trumpeter of Säckingen*, 1853, an epic poem of vagabond life mingling song and philosophical reflection, and *Ekkehard*, 1855, the most popular of German historical novels, the hero being a 10th century monk. *Gaudeamus*, 1868, is a collection of lyrics and parodies. Scheffel's works, though saturated with sentimentalism, are endowed with a fund of entertaining humor. He died in Karlsruhe, Apr. 9, 1886.

SCHEHARAZADE, the sultana who is supposed to narrate the tales in the ARABIAN NIGHTS. Beautiful and ready of wit, she so fascinated her husband with her stories, supposed to have been told over a period of 1,001 nights, that he at last annulled the decree that each of his wives should live but one day.

SCHELLING, ERNEST HENRY (1876-), American pianist and composer, was born at Belvidere, N.J., July 26, 1876. He studied piano and composition with Huber, Moszkowski, and PADEREWSKI. His violin concerto was first played by Fritz Kreisler and the Boston Symphony Orchestra in 1916. In 1923 critics favorably received the orchestral suite *Victory Ball*, performed by the Philadelphia Philharmonic Orchestra in 1923, and in 1927 another orchestral suite, *Morocco*, made a similarly favorable impression when played by the New York Philharmonic Orchestra. Since 1927 he has conducted the children's concerts of the New York, Boston, and Philadelphia philharmonic orchestras.

SCHELLING, FELIX EMANUEL (1858-), American educator, was born in New Albany, Ind., Sept. 3, 1858. He graduated from the University of Pennsylvania in 1881, returning in 1893 as John Welsh centennial professor of English literature. Schelling is the author of *English Literature During the Lifetime of Shakespeare*, 1910, and many critical and historical works on Elizabethan literature. He edited *Ben John's Discoveries*, 1892; *Beaumont and Fletcher*, 1912, and *Typical Elizabethan Plays*, 1926.

SCHELLING, FRIEDRICH WILHELM JOSEPH VON (1775-1854), German philosopher, was born at Leonberg, Jan. 27, 1775. Educated at Tübingen and Leipzig, he began his career as professor of philosophy at Jena in 1798. From 1806-20 he was secretary of the Munich Academy and in 1841 went

to the University of Berlin. His most important works are *The Philosophy of Nature*, 1797, and *Transcendental Idealism*, 1800. He died at Bad Ragaz, Aug. 20, 1854.

Schelling is a representative of romantic idealism. His philosophy is sometimes called the Identitäts philosophy because his Absolute consisted of a bare identity. When he did give it some positive character it took on esthetic aspects. Nature was looked at from the standpoint of the artist.

SCHENECTADY, a city in eastern New York, the county seat of Schenectady Co., situated on the Mohawk River and the State Barge Canal, 16 mi. northwest of Albany. Airplanes, bus and truck lines, canal barges and the New York Central and the Delaware and Hudson railroads afford transportation. The chief local manufactures are electrical goods and locomotives. The annual factory output is worth about \$100,000,000. The retail trade, 1929, amounted to \$59,477,601. Schenectady is the seat of Union College. The Great Western Gateway Bridge, spanning the river at this point, was opened in 1926. Schenectady was founded in 1611 by a Dutchman, Arent Van Corlaer, a cousin of Killian van Rensselaer. It became a city in 1798. Pop. 1920, 88,723; 1930, 95,692.

SCHENECTADY MASSACRE, Feb. 8, 1690. An expedition of 110 Canadians and Indians was despatched against Schenectady by the Comte de Frontenac, governor of Canada, as part of his opening campaign of KING WILLIAM'S WAR. The force had passed through the unguarded gates of the stockaded village before their presence was discovered. Sixty inhabitants, 17 of them children, were massacred. Approximately an equal number were taken captive, while a few inhabitants escaped afoot, over the snows, to Albany.

SCHERZO, a musical term used to indicate a lively tempo and a capricious manner; also the name of a movement in a symphony. As such it was substituted by Beethoven for the minuet of Haydn and Mozart, and either precedes or follows the slow movement. In Italian the word means "jest."

SCHICK TEST FOR DIPHTHERIA. See MEDICAL RESEARCH.

SCHIEDAM, a city in the Dutch province of South Holland, located west of ROTTERDAM and joining with it. Schiedam has a harbor, six churches, a synagogue, a fine concert hall and theater, and numerous gin distilleries, whose product is famous, making about 130,000,000 qts. annually. Pop. 1930, 52,727.

SCHIFF, JACOB HENRY (1847-1920), American banker and philanthropist, born at Frankfort-on-the-Main, Germany, Jan. 10, 1847. He came to the United States in 1865, and, after working as a bank clerk, launched a brokerage firm and obtained his first capital. In 1875, he married the daughter of Solomon Loeb, and shortly thereafter joined the banking firm of Kuhn, Loeb & Co., New York City, becoming its head in 1885. Under his direction, the firm financed the Harriman reorganization of the

Union Pacific Railway in 1897 and floated more than \$100,000,000 for projects for the Pennsylvania Railroad, including the Pennsylvania Station in New York City and its tunnels under the East and Hudson rivers. He was noted for his generous donations to Jewish agencies. He died at New York City, Sept. 25, 1920.

SCHILLER, JOHANN CHRISTOPH FRIEDRICH VON (1759-1805), German poet, dramatist and critic, was born at Marbach on the Neckar, Nov. 10, 1759, the son of an army surgeon. He studied theology, law and later medicine in the military school of the Duke of Wurtemberg. Here he wrote *Die Rauber*, a celebrated tragedy published in 1781. He then determined to devote himself exclusively to literature and in 1783 received a post as "theater poet" in Mannheim, where he wrote the *Kabale und Liebe*, a drama of lowly life performed in 1784. *Don Carlos*, 1787, historical drama in blank verse, added to his reputation. The historical studies that led to his *History of the Thirty Years' War*, 1791-93, also led to the production of his famous trilogy on *Wallenstein*, 1798-99. *Maria Stuart*, 1800, and an exceptional dramatic tragedy, *Die Jungfrau von Orleans*, 1801, were the masterly preliminaries to his last great dramatic achievement, *Wilhelm Tell*, 1804. The last decade of his life was considerably influenced by his intimacy with Goethe and resulted in that influential collection of essays entitled *Über Naive und Sentimentale Dichtung*, 1795-96. In this work he gave classical expression to that esthetic philosophy that lay at the basis of the work of the Weimar School. Although German critics accord to Goethe first place in their admiration and affection, they freely grant that Schiller is most completely representative of the ideals and aspirations of his generation. Schiller died at Weimar May 9, 1805.

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SCHINKEL, KARL FRIEDRICH (1781-1841), German architect and painter, was born at Neuruppin, Mar. 13, 1781. He studied in the Berlin Architectural School and then traveled widely studying architectural monuments in France and Italy. In 1811 he returned to Berlin and as a member of the Royal Academy his influence upon German architecture of the first half of the 19th century made him one of the dominant figures of the classical revival. He designed the Berlin Astronomical Observatory, the Architectural School, the Opera House, the Casino and parts of the group of palaces at Potsdam. His painting eventually was largely confined to murals and theatrical scenery. He built a few churches in a style he created by modifying Gothic in a classical direction. In addition he considerably influenced the improved standard of taste in the industrial arts. He died at Berlin, Oct. 9, 1841.

SCHISM OF THE WEST, THE GREAT, a temporary division of the Catholic Church caused by rival claimants to the Papal election. The schism lasted from 1378 to 1417 and was caused by the

political ambitions and intrigues of the French court. Clement VIII, who resided at Avignon, contested the election of Urban VI to the papacy, and a line of rival claimants followed until the election of Martin V in 1417.

SCHIST, a general term for rocks characterized by the ease with which they may be split into thin foliae, or platy fragments. This structure results from the prevalence in such rocks of minerals showing a markedly lamellar structure, like MICA, CHLORITE, TALC and HORNBLENDE, or to the fact that normally granular ones such as QUARTZ or CALCITE have been flattened by intense shearing stresses to which the rock was subjected. Schists are METAMORPHIC ROCKS, produced from pre-existing sedimentary or igneous rocks by pressure, heat and movement in large bodies of deeply buried rocks. New minerals are frequently developed, and the lamellar ones assume parallel orientations under the influence of pressure. Schists are usually named according to the most prominent mineral present, as quartz, mica, chlorite, talc, SERICITE, Hornblende and GARNET schists.

The property of breaking into thin foliae is called schistosity, and in its most perfect form is shown by slates. See also METAMORPHISM; PETROLOGY.

SCHISTOSOMIASIS. See BILHARZIASIS; TROPICAL MEDICINE.

SCHLEGEL, AUGUST WILHELM VON (1767-1845), German writer and romanticist, was born at Hanover, Sept. 8, 1767. Educated at Göttingen, he lived at Amsterdam until 1796, and 2 years later became professor at Jena. There he began his German translations of Shakespeare, one of the most perfect translations in any language. He began at the same time editing with his brother Friedrich *Athenaeum*, a periodical of the Romantic movement. In 1803 he published translations of Calderon and thereafter traveled over Europe for years in the entourage of Mme. de Staël. From 1823 to 1830 he edited and published works on oriental languages, and introduced the study of Sanskrit into Germany. Schlegel died at Bonn, May 12, 1845.

SCHLEGEL, FRIEDRICH VON (1772-1829), German poet and critic, was born at Hanover, Mar. 10, 1772. He studied law at Göttingen and Leipzig but turned to literature and became lecturer at the University of Jena. In 1797 he published *Die Griechen und Römer*, one of the basic works of Romantic Classicism in the 19th century. He joined his brother August in founding *Athenaeum*, wrote two novels and in 1803 became editor of *Europa* at Paris. Converted to Catholicism in 1808, Schlegel began to turn from the political libertarianism inherent in the Romantic movement. His collected poems were published in 1809 and his history of literature, *Geschichte der alten und neuen Literatur*, in 1815. Schlegel died at Dresden, Jan. 11, 1829.

SCHLEIERMACHER, FRIEDERICH D. E. (1768-1834), celebrated German theologian and philosopher, was born at Breslau, Germany, Nov. 21, 1768. He studied theology at Halle and was ordained

in 1794. From 1796 to 1802 he was pastor of the Charité Hospital in Berlin and then for two years, court chaplain at Stolpe, Pomerania. After a brief professorship at Halle, in 1807 he became pastor of Trinity Church, Berlin, and in 1810 professor of theology in the new university there, both of which positions he held until his death. As president of the Synod in Berlin, 1817, he attempted to effect a union of the Lutheran and Reformed churches on a base of common spiritual life. His chief book was *Der christliche Glaube nach den Grundsätzen der Evangelischen Kirche*. His translation of Plato (1804-28) gave him a reputation as a philosopher. Schleiermacher died at Berlin, Germany, Nov. 21, 1834.

SCHLESWIG-HOLSTEIN, a Prussian province in northwestern Germany, situated just south of Denmark, between the North Sea and two arms of the Baltic. The province, made up of two former duchies, has an area of 5,818 sq. mi. including a few small islands. The southern part is famous for Holstein cattle. Other leading products are horses, grain, fish and oysters. The capital is Schleswig, but larger cities are Kiel, the important seaport at the eastern end of the Kiel Canal, and Altona, about 40 mi. from the mouth of the Elbe. The total population is about 1,600,000.

Schleswig and Holstein were taken from Denmark by Prussia in 1866, and all efforts of the Danish-speaking peoples of the northern province to regain their Danish nationality were ineffectual until after the World War. (See SCHLESWIG-HOLSTEIN, QUESTION OF.) The restored Danish portion, with an area of 1,502 sq. mi., and a population of about 180,000, is now known as North Slesvig, or the South Jutland Province.

SCHLESWIG-HOLSTEIN QUESTION, THE, resulted from the two duchies being under one government, but only one, Holstein, being a member of the German Confederation. Their annexation to Denmark in 1864 drew Prussia and Austria into war against Denmark. Victors, the two allies were unable to agree on the disposal of the provinces and in 1866 war broke out between them. Prussia was almost immediately victorious and incorporated both provinces in the Kingdom of Prussia. Plebiscites demanded by the Versailles Treaty in 1920 gave North Schleswig to Denmark, the remainder to Germany.

SCHLEY, WINFIELD SCOTT (1839-1911), American naval officer, was born Oct. 9, 1839, near Frederick, Md. He was graduated from the U.S. Naval Academy in 1860, and saw action in several engagements in the Civil War. He was promoted to the rank of lieutenant commander in 1866. During 1866-69 he was instructor in modern languages at the Naval Academy, and in 1870-73 was stationed in China, where he engaged in considerable fighting, being promoted to commander in 1874. He was later stationed in Brazil and in 1884 commanded the relief expedition which found the Arctic explorer, Greeley, and six survivors. In 1888 Schley was promoted to captain and placed in various commands. He was made

commodore in Feb., 1898, and commanded the Flying Squadron at the outbreak of the Spanish-American War. In May, 1898 he located and blockaded Cervera's fleet in the harbor of Santiago, where a few weeks later Rear Admiral Sampson arrived and took command. A few hours' absence of Sampson on July 3, 1898, left Schley in command and at that moment Cervera attempted to escape from Santiago. In a running fight, his fleet was completely destroyed, Sampson hurrying back in time to command the last of the action. This precipitated a heated controversy between the two commanders which lasted for several years and which also brought about a court of inquiry which resulted in censure of Schley in 1901. He was made rear-admiral in Apr., 1899, and died Oct. 3, 1911, at New York.

SCHLIEMANN, HEINRICH (1822-90), German archeologist, was born at Neu Buckow in Mecklenburg-Schwerin, Jan. 6, 1822. He made a fortune in the indigo trade, traveled extensively in Europe, India, China, Japan and the United States and mastered eight languages. In 1870 he began the excavation of Hissarlik in Asia Minor to substantiate his theory that that city and not Bunarbashi was the site of ancient Troy. The "Troy" which he discovered was several cities beneath the real Troy. He made valuable discoveries at Mycenae in 1876, at Orchomenus in 1881 and at Tiryns in 1884 and wrote many books describing his finds. He died at Naples Dec. 27, 1890.

SCHLOSSER, FRIEDRICH (1776-1861), German historian, was born at Jever, Nov. 17, 1776. He was tutor in a number of princely and noble families, and professor of history and philosophy at Frankfurt after 1812, where he became City Librarian in 1814. In 1817 he became professor of history at Heidelberg University. His more important works are *History of the World in Connected Narrative*, 1817-24, *History of the 18th Century*, 1823. In the 5th edition he continued this into the 19th century to include the French Revolution. He died at Heidelberg, Sept. 23, 1861.

SCHMALKALDIC LEAGUE, THE, or Smalkald League, of Protestant states was formed in Dec. 1530 to oppose the decision of the Diet of Augsburg framed in Nov. 1530 that Protestantism should be forcibly suppressed after Apr. 15, 1531. A number of the north German princes, led by Landgrave Philip of Hesse, abandoned the Lutheran principle of passive resistance to the Emperor and resolved to meet force with force. Several south German cities joined, but after the death of Zwingli in Oct. 1531 the League gravitated to Wittenberg. It became a strong political force, anti-Hapsburg in policy. Two factors reduced the power of the League. The first was the removal of pressure, for the decision of the Diet of Augsburg was never enforced; the second was the bigamy of Philip of Hesse, who, to gain immunity for his offense, had to abandon his allies.

SCHNEIDEMÜHL, a German city, capital of the frontier district Posen-West-Prussia, situated about 60

mi. north of Posen. The city has a number of administrative bodies and schools, machine, starch, cement, pasteboard and lime-sandstone factories. The trade is chiefly in grain, lumber and leather. Schneidemühl received German municipal law 1513 and in 1844 the first German Catholic parish was founded. The Polish name was Pila. It has been Prussian since 1772. Pop. 1925, 35,518.

SCHNEIDER, HERMAN (1872-), American educator, was born at Summit Hill, Pa., Sept. 12, 1872. He graduated from Lehigh University, 1894, and took his Sc.D. at the University of Pittsburgh, 1911. From 1894-99 he engaged in structural iron-work and railroad engineering; then joined the engineering faculty of Lehigh. In 1903 he went to the University of Cincinnati, where he held various posts until 1929, when he became president of the university. From 1917-18 Schneider was chief of the industrial service section of the War Department.

SCHNITZLER, ARTHUR (1862-1931), Austrian dramatist and novelist, was born in Vienna in 1862. Of Jewish descent, Schnitzler is, however, Viennese in temperament and his attitude towards life. He took his degree in medicine in Vienna, 1885, but turned to literature, and produced *Anatol* in 1893. Other plays include *Liebelei*, *der Grüne Kakadu*, *Lebendige Stunden*, *Marionetten*, *Der Einsame Weg*, *Das Märchen*, *Das Weite Land* and *Professor Bernhardt*. Some of his novels are *Sterbin*, *Leutnant Guett*, *Die griechische Tänzerin*, *Der Weg ins Freie*, *Masten und Wander* and *Frau Beate und ihr Sohn*. Many of these works have been published in English, and *Anatol* was produced in New York in 1912 and 1931. Schnitzler died at Vienna, Oct. 21, 1931.

SCHOFIELD, JOHN McALLISTER (1831-1906), American soldier, was born in Gerry, Chautauqua Co., N.Y., Sept. 29, 1831. Graduating from West Point Military Academy in 1853, he became officer in the artillery and two years later returned to teach at West Point. He was with the Federal army in Missouri during the Civil War and, in 1864, was put in command of the Army of the Ohio and took part in Sherman's march through Georgia. In November of that year he fought the battle of Franklin in Tennessee, whence he again joined Sherman in the Carolinas in 1865. He was made brigadier-general of volunteers and brevet major-general. In 1868-69 he was Secretary of War and in 1876-81 was superintendent of West Point. He was commanding general of the U.S. Army in 1889-95. He died at St. Augustine, Fla., Mar. 4, 1906.

SCHOLASTICISM, the dominant philosophy of the Middle Ages. It is an application of Aristotelian logic to Christian theology. Beginning in the 9th century, it reached its height with SAINT THOMAS AQUINAS (1224-74), after which it gradually declined.

The two leading controversies of the period were between the realists and the nominalists, and the Thomists and the Scotists. In the social setting of the time the issues between realism and nominalism had significance, for the authority of the church over

the individual was intimately concerned in the question of which was the more real, the universal or the particular. If it could be shown that the universal were more real, the church's claim over the destinies of its individual members would be established.

The issue between the Thomists and the Scotists concerned the primacy of the intellect or the will, the Thomists holding to the superiority of the intellect, the Scotists maintaining that the intellect is determined by the will.

Scholasticism has come to stand for mere intellectual cobweb-spinning, and to call a thing scholastic is regarded as sufficient to condemn it. Nevertheless there is a growing interest in the scholastic period at the present time.

SCHÖNBERG, ARNOLD (1874-), Austrian music composer, was born at Vienna, Sept. 13, 1874. Self-taught until he was 20, he then studied with his brother-in-law, Alexander von Zemlinsky. He taught in Berlin and Vienna, but his interests were always largely creative. Such of his earlier compositions as *Verklärte Nacht*, a string sextet, and the symphonic poem *Pelléas und Mélisande* are examples of a true melodic gift and a subtle harmonic style, but in 1914 he definitely abandoned his previous manner for experiments of the most pronounced harmonic freedom which at once placed him among the radicals of modern music. The most famous of his compositions in this new manner is *Pierrot Lunaire*, a work for voice and chamber-music instruments, which evoked both praise and condemnation from critics in Europe and the United States. This latter style, as illustrated by his experimental *Die glückliche Hand*, a monodrama with chorus, is characterized by extreme compression and nearly complete absence of definite key.

SCHÖNEBERG, Berlin-Schöneberg, a city of Germany in the former Prussian province of Brandenburg. Since 1920 it has been part of Greater Berlin and the seat of the 11th municipal administrative district. There is but little industry, as it is primarily residential. The district adjoins what was formerly Berlin, Charlottenburg and Wilmersdorf, as well as the neighboring Friedenau. First mentioned in 1264, Schöneberg has been a city since 1898. Pop. 1919, 195,093.

SCHÖNLEIN, JOHANN LUKAS (1793-1864), of Bamberg, Germany, was the founder of the so-called Natural History School, the ambition of which was to study medicine in the same manner as descriptive botany and zoology are studied. In his clinic in Berlin he was the first to lecture on medicine in German instead of Latin, and was the founder of modern clinical teaching in Germany, introducing examinations of the blood and urine, chemical analysis, ascultation, percussion and microscopic investigations. His scientific abilities have been described in the well-known eulogy of Virchow (1865). M. F.

SCHOOL ADMINISTRATION. Except for the development of objective methods in educational psychology no branch of the study of education has made

such rapid progress in the United States as school administration. This has been due to two factors; the first is the absence of a central educational authority to exercise leadership, to define policies, and to bear a share of the financial burden in education; the second has been the remarkable growth of the American educational system which has demanded efficient methods of administration on the same scale as large industrial enterprises. In those countries in which education is administered mainly by a central authority, a Ministry of Public Instruction, everything tends to be defined by official decrees, legislation and documents defining even the minutest details of the educational system, the preparation and salaries of teachers, the character of the school buildings, the types of schools, the curriculum and time-schedules, the courses of study, and the standards of examinations. Such was the character of administration in the German states before the War. Such is still its character in France and, with some differences, in Italy. Where this type of administration prevails its conduct is entrusted in the main to officials of the Ministries, usually known as inspectors, or occasionally is delegated to local officials. In England where public education is provided in a partnership between the central Board of Education and the local authorities, the broad general lines of the system are defined by the board and the details are left to the local education committees to be administered by their own appointed officials. See EDUCATION, NATIONAL SYSTEMS OF.

Local Jurisdiction. In the United States, however, the character of educational administrations has been determined by its origin from the local or district system. Under the Constitution education was left to the states, and the participation of the Federal Government has on the whole been negligible except in certain fields, such as agricultural, vocational and home-making education. The states in turn delegated their functions to local areas, districts, towns and cities, and counties. In the absence of central educational authorities, leadership has had to be sought elsewhere and has been provided by the emergence in the last 25 years of the expert administrator, the public school superintendent, now generally trained. The superintendent is more than an administrator; he is largely responsible for analyzing the educational needs, for giving direction to new movements, and for determining new policies even though the final decision rests with the local board of education, which is more directly responsible to the public.

Because of the magnitude of the ramifications of his task the superintendent is increasingly becoming an official who has had several years of training in institutions which have emerged to respond to the new demands and which in turn also conduct research in problems which confront the superintendent. As a further aid in the improvement of administration and consequently of education, the practice has developed of calling experts into consultation or, in other words, to conduct surveys on a particular problem,

such as finance, buildings, curriculum, etc., or on every aspect of a system. In addition many progressive systems have established bureaus of educational research. In the last resort the features which distinguish the character of school administration in the United States are that, first, it is in the main local and, secondly, responsible to the public. Hence arise the chief problems of American school administration.

Special Problems in the United States. Among these the most important problem is to secure and maintain the interest of the public which pays for the maintenance of education and sends its children to the schools. This task has become particularly essential because of the changing character of the school, the expansion of educational opportunities, and the increased cost involved thereby. To meet this task extensive schemes of educational publicity have been developed and employed either periodically or continuously to keep the public in touch with what is going on in the schools and with proposals for change. The same necessity of taking the public into partnership has been recognized in England and Germany by the institution of education weeks and school exhibitions, methods to which no resort is made in systems that are highly centralized.

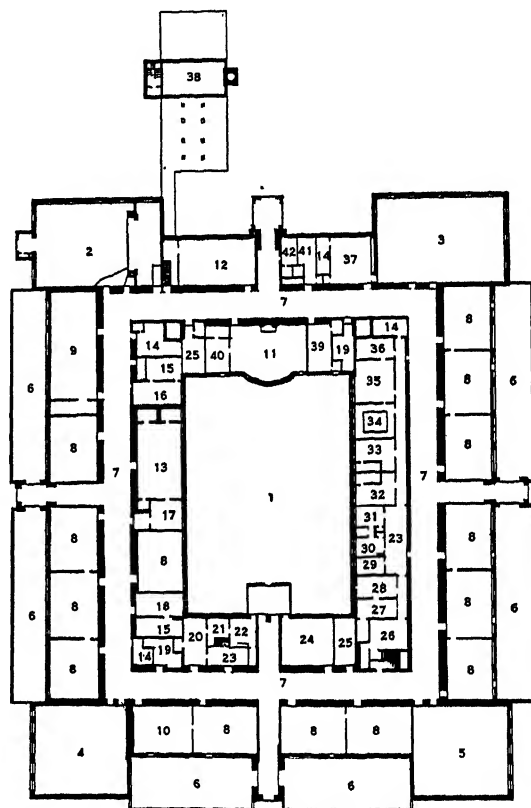
Publicity here obviously has to serve one main purpose, to improve education. But to improve education the financial support of the public through taxation for fixed charges and through other methods, such as raising of bonds, for capital outlays, particularly for buildings, is essential. Hence other important tasks of the school administrator include drawing up the school budget, supervising expenditures, planning the building program, making the best use of school buildings, and so on even before the real function of education begins. All these functions of the administrator, who in the larger school systems has under him a large staff of assistants, delegated for special duties, are, however, preliminary to the main purpose of school administration which is to see that the right child receives the right education from the right teacher. This involves the administration of pupil census and attendance, the proper classification of pupils, provision for health supervision, the selection of suitably qualified teachers, the supervision of instruction, the selection and purchase of textbooks. In the past the administrator assumed the responsibility of curriculum making. More and more, however, the cooperation of the teachers is being enlisted in this task, sometimes under an expert in the system, sometimes under the guidance of an expert from without. For the promotion of educational efficiency there are employed special supervisors, and in the larger systems educational psychologists or a bureau of research. Despite the fact that there is no central national authority for education, national norms are being developed in a variety of ways: educational literature, national conferences, and the research publications of the Department of Superintendence. I. L. K.

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SCHOOL AND COLLEGE DRAMATICS. See THEATER SCHOOLS, EDUCATIONAL DRAMATICS.

SCHOOL ARCHITECTURE, a term commonly applied to public school buildings of the United States, classed as elementary school houses, intermediate or junior high, senior high and the vocational, technical and commercial schoolhouses. The pride of

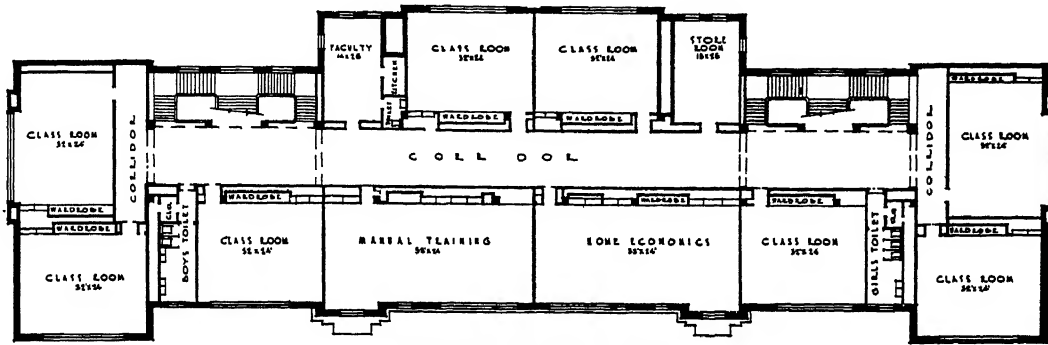


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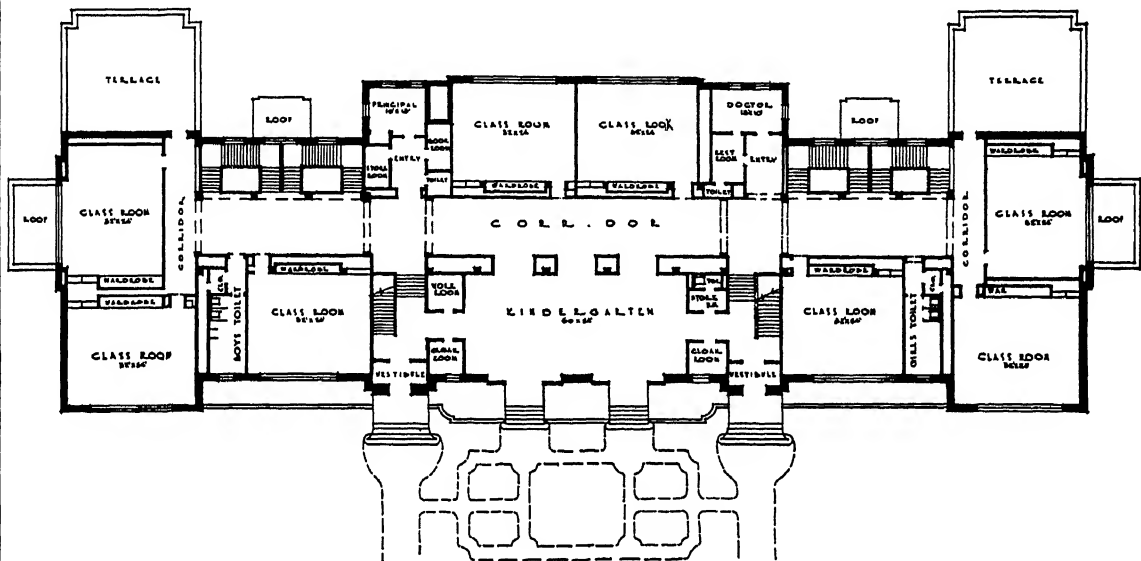
GROUND FLOOR PLAN, OAKMAN SCHOOL, DETROIT, MICHIGAN.
SMITH, HINCHMAN AND GRYLLS, ARCHITECTS

1, court; 2, auditorium; 3, lunch; 4, cot room; 5, play room; 6, terrace; 7, corridor; 8, class; 9, arts and crafts; 10, library; 11, kindergarden; 12, manual training and printing; 13, sewing and cooking; 14, storeroom; 15, shower; 16, boys' lockers; 17, teachers' dining-room; 18, girls' lockers; 19, girls' toilet; 20, reception room; 21, principal; 22, clerk's office; 23, wash room; 24, science; 25, boys' toilet; 26, play and picture room; 27, infirmary; 28, examination; 29, dentist; 30, doctor; 31, nurses; 32, girls' dressing room; 33, boys' dressing room; 34, tank; 35, physiotherapy; 36, heliotherapy; 37, kitchen; 38, boiler room; 39, teachers' rest room; 40, cloak room; 41, men attendants; 42, women attendants

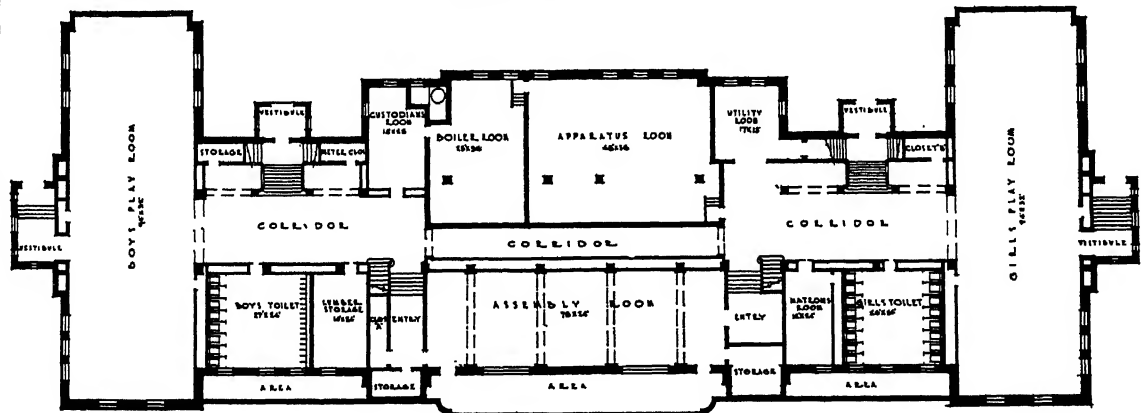
communities, the anxious attitude of parents, the pressure of attendance, the mixed quality of the student body, the unwholesome atmosphere of congested cities, an increasingly exacting public hygiene and a constantly developing engineering technique have combined to cause the enactment of a body of city and state laws in which are found guiding principles



SECOND FLOOR PLAN



FIRST FLOOR PLAN



GROUND FLOOR PLAN

SCALE IN FEET
0' 5' 10' 15' 20'

COURTESY BOARD OF EDUCATION, ST. LOUIS, MO.

FLOOR PLANS OF THE J. G. WOERNER SCHOOL BUILDING, ST. LOUIS, MISSOURI. ERNEST T. FRITON, ARCHITECT

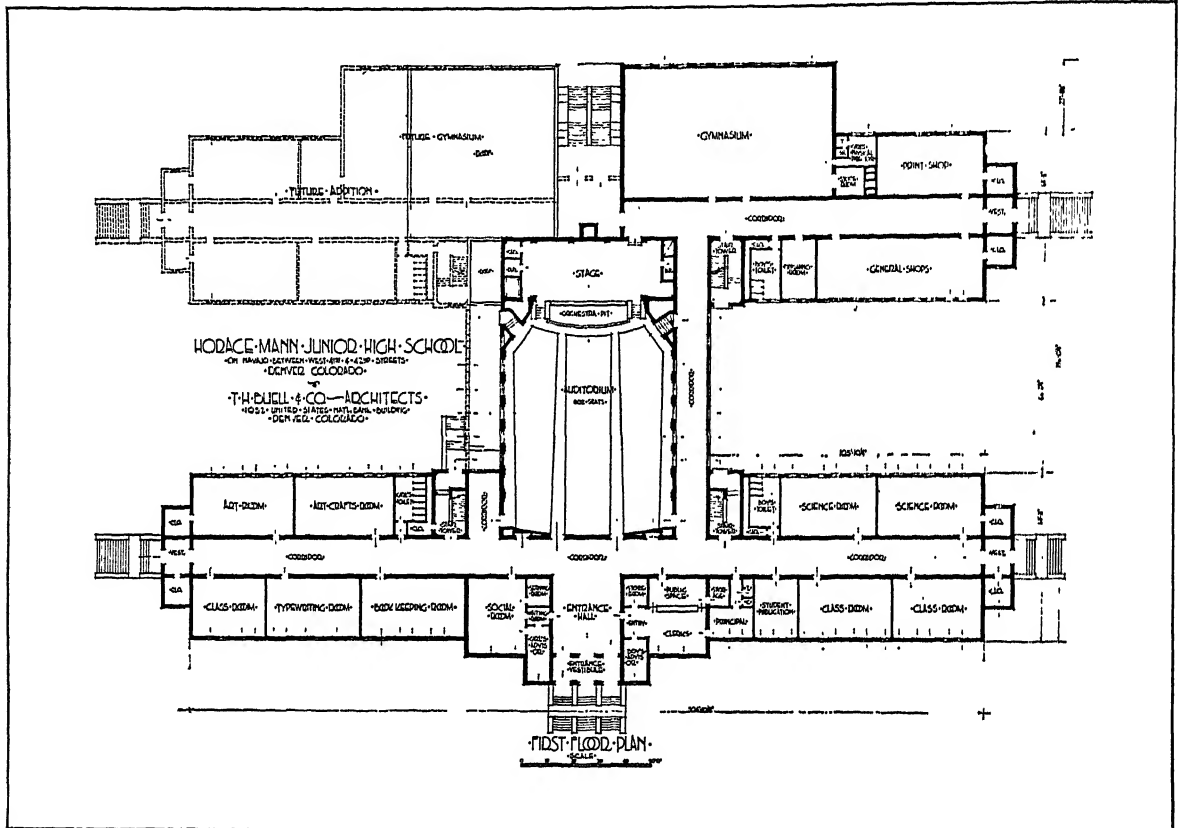
SCHOOL ARCHITECTURE

as well as mandatory requirements for the design of schoolhouses. That some of these requirements are ill advised there can be no doubt; but equally true is it that in the main they have led to the erection of school buildings generally safe and sanitary.

Notwithstanding a wide difference in the locations of school buildings, there are certain desiderata and exigencies applying to all. A common interest has led to common agreement, and this agreement is found reflected in a marked standardization which assists an architect to meet the demands of critical taxpayers to make each dollar go as far as possible. Thus legal

of purposes should be brought together, the noisy shops kept apart and the whole arranged to facilitate the easy and speedy movement of classes.

In most cases appropriations must be spent for utmost student capacity rather than architectural embellishment. The ratio of peripheral wall to floor plan area, and the least possible cubical content must then be kept in mind. The former imposes a compact plan, the latter flat roofs above which the walls extend as parapets. The architectural result is a simple and dignified composition without extraneous embellishment, the walls of the building being decorated by



FLOOR PLAN OF THE HORACE MANN JUNIOR HIGH SCHOOL, DENVER, COLORADO. T. H. BUELL & CO., ARCHITECTS

standards in planning a schoolhouse often dictate the following: conditions under which the building must be wholly fireproof; distance of any floor containing an auditorium above the outside grade; size of schoolrooms; area of clear glass of window in relation to floor area of classrooms; height of sills and heads of windows and distance of window head below ceiling; widths of corridors and stairs and the proportions of steps; height of handrail; firetowers; spacing of seats; direction of light with respect to position of desks; amount of fresh air and its temperature per pupil per minute, etc., etc.

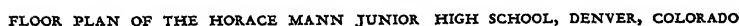
The plan is of first importance, for upon its disposition of parts depends the smooth working of the schoolhouse under actual use. Rooms with similarity

the manner of laying or treating their integral material.

There are some circumstances, however, which are favorable to ingenuity of design. One of these is an open site permitting windows upon all sides. Another is the universal desirability of the unilateral lighting of classrooms, permitting large areas of blank wall to be contrasted with window areas on the exterior. The firetowers of high school buildings in cities offer an opportunity for a designer's invention in obtaining architectural effect. There are also opportunities for dignified and imposing entrances that may offset the effect of factory-like bays of clustered windows imposed by the codes. The proximity of playing fields and grandstands to large high school buildings

Where open sites and adequate funds have been available, American architects have distinguished themselves in designing school buildings of great diversity and in displaying astonishing degree of invention. Particularly inviting and heedful of child psychology are the one-story elementary schoolhouses of California; yet in no less degree do the high monumental structures of our large cities, where land is costly, fulfill the demands of their particular communities. A growing tendency is to make community centers

SCHOOL FOR HUSBANDS, THE (*l'École des Maris*), a play by the French dramatist, MOLIÈRE; produced 1661. The father of Isabelle and Léonor entrusts his daughters to the keeping of two brothers, Sganarelle and Ariste. The narrow-minded Sganarelle restricts Isabelle in even the most innocent pleasures, and is repaid for all his jealous despotism when Isabelle, despising her jailor-like guardian, elopes with a young lover, Valère. On the other side, Ariste,



C. Z. K.

SCHOOLCRAFT, HENRY ROWE (1793-1864), American traveler and writer, was born at Guilderland, N.Y., Mar. 28, 1793. He studied chemistry and in 1820 accompanied Gen. Lewis Cass as geologist on an expedition to the upper Mississippi River and the Lake Superior copper region. Three years later he was appointed Indian agent for Lake Superior county. In this capacity he concluded several suc-

SCHOOL FOR SCANDAL, THE, a brilliant comedy by RICHARD B. SHERIDAN; produced 1777. Sir Peter Teazle, a hearty, crude old fellow, much harassed by a capricious young wife, has a ward, Maria, who is courted by two brothers: Joseph Surface, an unctuous and deliberate young villain, is the more favored of the two, whereas Charles Surface is considered too wild and frivolous. But Sir Oliver Surface, the boys' wealthy uncle, disguises himself as a money-lender and, studying both nephews at close quarters, shows up the cold-blooded scheming of Joseph and decrees that Charles shall have his money.

and the hand of Maria as well. The play scintillates with wit and paradox.

SCHOOL FOR WIVES, THE (*l'École des Femmes*), a play by MOLIÈRE; produced 1662. It is a companion-piece to **THE SCHOOL FOR HUSBANDS**. The middle-aged Arnolphe is entrusted with the keeping of a beautiful young girl, Agnès, of whom he becomes so insanely jealous that he imposes upon his ward all manner of cruel restrictions. This jealous harshness is rewarded but poorly, for the stern guardian, returning one day from a journey, discovers that Agnès has fallen in love with Horace, the young son of his friend Orante. In a superbly dramatic scene Arnolphe pleads with the girl, endeavoring with impassioned arguments to maintain his hold upon her. But Agnès departs with her lover.

SCHOOLS. The subject of schools is treated under the following heads: PUBLIC SCHOOLS; VOCATIONAL SCHOOLS; EVENING SCHOOLS; CORRESPONDENCE SCHOOLS; SUMMER SCHOOLS; JUNIOR HIGH SCHOOLS; PAROCHIAL SCHOOLS; BUSINESS ADMINISTRATION, SCHOOLS OF.

SCHOOL SHIPS, STATE, vessels commissioned under special laws for the instruction and training of boys and young men in practical seamanship, navigation and engineering. Under the term Nautical School Ships, the Act of Congress of June 1874, as since amended, allows the establishment of ships of the U.S. Navy at certain principal ports of the United States. The vessels selected are commanded, and at times officered, by naval officers. They are partly supported by local or state authorities. The amount to be appropriated by such authorities is in addition to \$25,000 appropriated by the government in each school ship case. Old cruisers with sail and auxiliary power are used. Pennsylvania, Massachusetts, New York and California operate school ships.

Young men under the age of 20 in general enter the school ships as cadets on passing the required examination. The course is two years; seamanship, navigation, engineering and electricity are taught theoretically and practically. Much time is spent at sea, particularly on foreign cruises. The graduates of these schools generally enter the merchant marine service, although a few enter the NAVY and MARINE CORPS, COAST GUARD and COAST AND GEODETIC SURVEY. R. E. C.

SCHOOLS OF THE THEATER. See THEATER SCHOOLS.

SCHOOL SURVEYS, organized studies of schools in states, counties or cities covering some particular phase, such as school administration, school buildings, curriculums or general educational development. These surveys may be made by the state or city authorities, by an educational group, such as the GENERAL EDUCATION BOARD, or by the United States Bureau of Education at the request of the state or city. The findings usually include recommendations for meeting the special needs of the community studied.

Though individual studies of school systems had been made as far back as the middle of the 19th cen-

tury, it was not until 1912 that a school survey on a big scale was attempted, this being the New York survey which was made in an effort to determine the budget necessary to maintain the schools efficiently. The next year a survey for the same purpose was made in Portland, Ore. Since then practically every state and most of the larger cities have had school surveys on some scale. In 1929 the United States Bureau of Education was authorized by Congress to make a three-year national survey of secondary education. This work started in July of that year. The survey was made under the supervision of advisory boards, including consultants to determine the major policies; educators to advise on undertaking and to interpret the findings to those engaged in secondary education, and laymen to interpret the findings to the public. The survey of President Hoover's National Advisory Committee on Education was the first commission in American history to survey Federal relations to education. M. R.

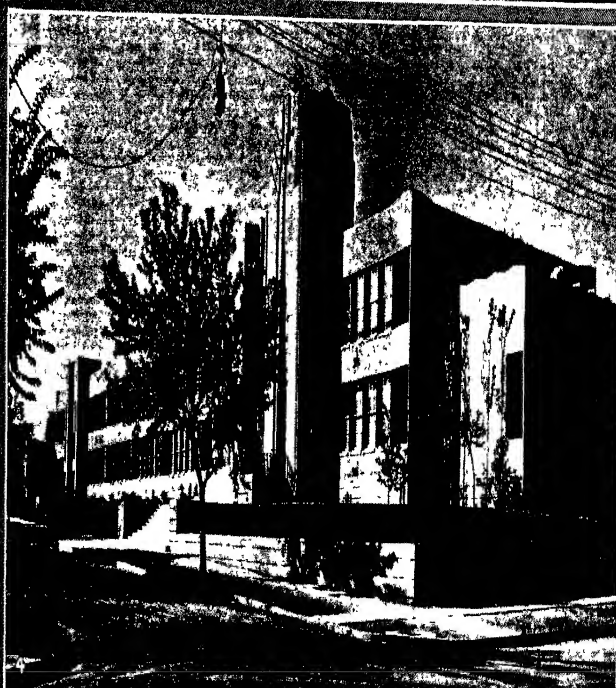
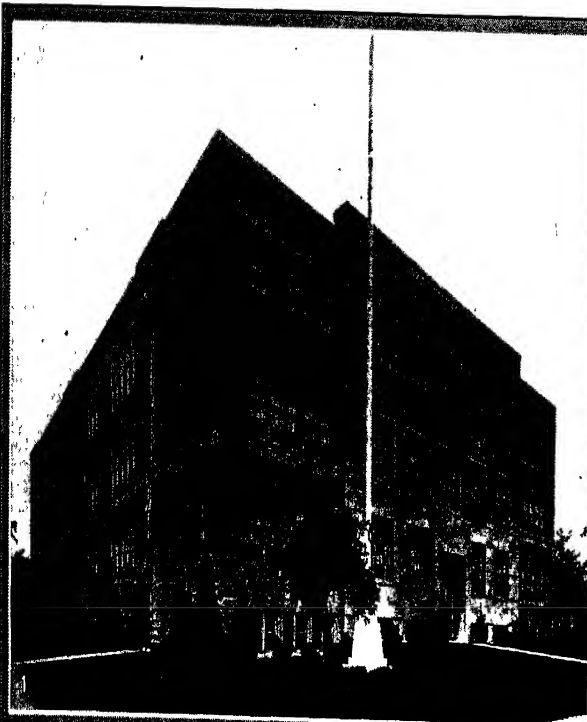
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SCHOONER. See YACHT.

SCHOPENHAUER, ARTHUR (1788-1860), German philosopher, was born at Danzig, Feb. 22, 1788. He studied at Göttingen, 1809-11, and at Berlin, 1811-13. From 1820-31 he taught philosophy at Berlin. The remainder of his life was spent in retirement at Frankfort-on-the-Main, where he died Sept. 21, 1860. His most important work, *The World as Will and Idea*, appeared in 1818.

Schopenhauer is noted for his pessimism which was an outgrowth of his general philosophic position. His interest in Buddhism, together with a neurotic disposition, was also a factor in producing his pessimistic outlook. It is will that is regarded as the fundamental reality. The nature of this will is a ceaseless striving. Nature everywhere presents a spectacle of constant and endless striving. It goes on at different levels but it is essentially the same process throughout. In man this everlasting striving of the will leads to the dilemma of insatiety on the one hand and ennui on the other. The satisfaction of desire produces nothing but ennui, while its dissatisfaction brings only more striving. Since all things possess this will to live, the only way to salvation is its universal surrender. Yet Schopenhauer did not advocate suicide. His emphasis on will has helped turn the tide against intellectualism and has led to a more voluntaristic approach both in philosophy and in psychology.

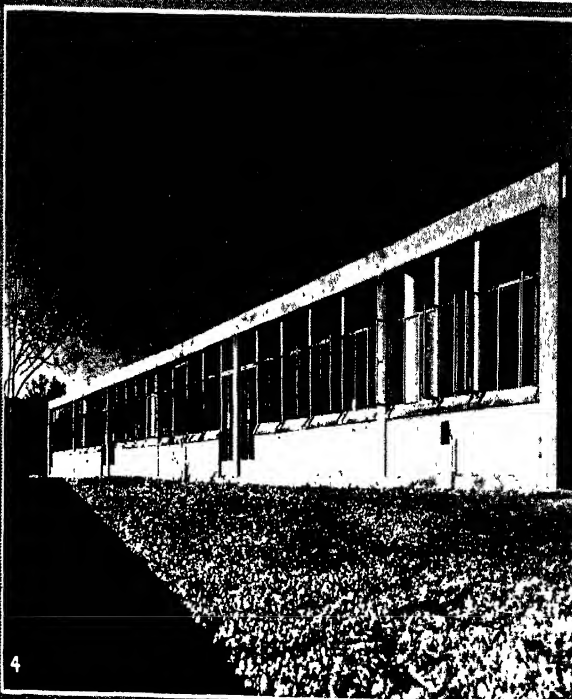
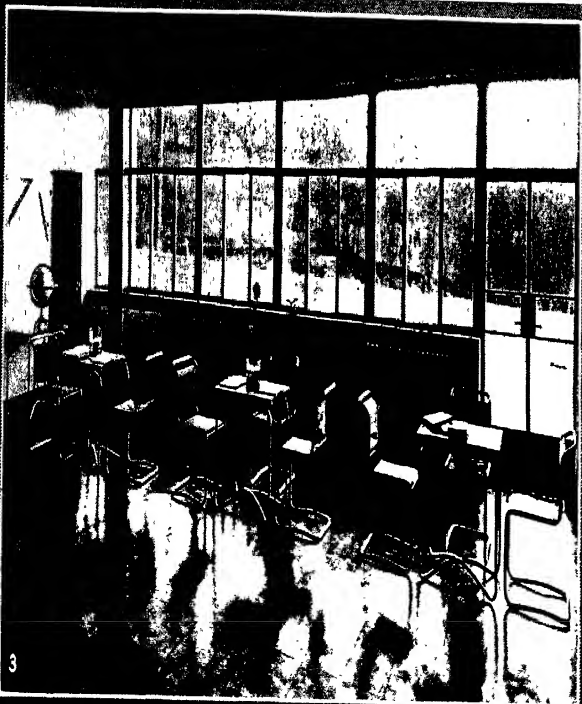
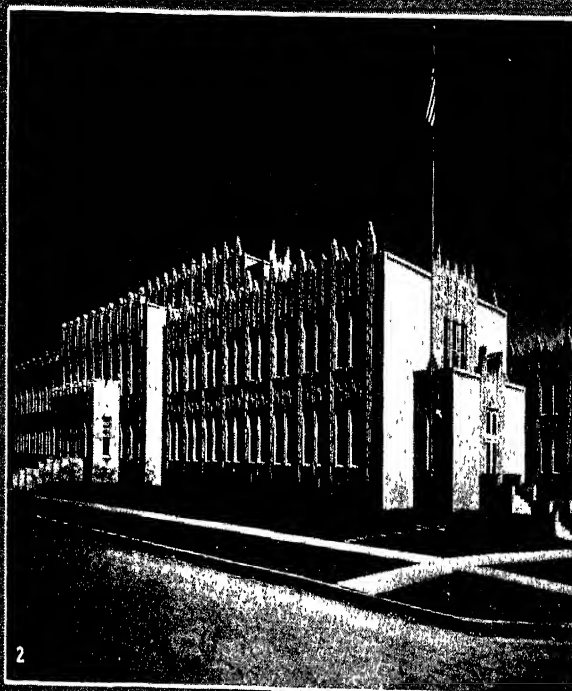
SCHOULER, JAMES (1839-1920), American lawyer and historian, was born at Arlington, Mass., in Mar. 1839. He served as professor of law at Boston University in 1882-1902, and as lecturer on American history at Johns Hopkins in 1891-1908. He was president of the American Historical Association in 1896-97. His writings include *The Law of Domestic Relations*, *The Life of Thomas Jefferson*,



1, COURTESY NEWARK PUBLIC SCHOOLS; 2, 4, DENVER PUBLIC SCHOOLS; 3, ST. LOUIS BOARD OF EDUCATION

PUBLIC SCHOOL ARCHITECTURE IN THE UNITED STATES

1. Ivy Street Grade School, Newark, New Jersey. Simpson and Rolston, Architects.
2. East Denver High School, Denver, Colorado. George H. Williamson, Architect.
3. Alexander Hamilton School (elementary grades), St. Louis, Missouri. R. M. Milligan, Architect.
4. Bryant-Webster Elementary School, Denver, Colorado. G. Meredith Musick, Architect.



1, COURTESY DEPT. OF VISUAL EDUCATION, DETROIT PUBLIC SCHOOLS; 2, 3, HESSIAN HILLS SCHOOL; 4, DENVER PUBLIC SCHOOLS

ELEMENTARY AND HIGH SCHOOL ARCHITECTURE IN AMERICA

1. Playground for younger children, Oakman School for Cripples, Detroit, Michigan. Smith, Hinchman and Grylls, Architects.
2. Horace Mann Junior High School, Denver, Colorado. T. T. Buell & Co., Architects.
3. Classroom, Hessian Hills School, Croton-on-Hudson, New York. Howe and Lescaze, Architects.
4. Main building, Hessian Hills School.

Eighty Years of Union, and A History of the United States Under the Constitution. He died at Intervale, N.H., Apr. 16, 1920.

SCHRAEH DAM, located on Waeggital Creek, a small mountain stream tributary to the Lake of Zurich, Switzerland, is the highest existing concrete gravity dam in the world, its crest being 362 feet above the deepest point of the foundation and 220 feet above the bed of the stream. Its length on top is 550 feet, its greatest thickness at the base 246 feet and it contains 305,000 cubic yards of concrete. The reservoir holds more than five billion cubic feet and stores water for use in the generation of electric power. The dam is of the non-overflow type, excess water being discharged through a gate-controlled diversion tunnel. An unusual feature in the construction of this dam was that the work of excavation for and placing concrete in the deepest portion of the dam was done through vertical shafts after the dam had been built up high enough for the concrete to support itself across a very narrow rock gorge 45 feet deep, which was encountered at a depth of 100 feet below the alluvial floor.

SCHUBERT, FRANZ PETER (1797-1828), Austrian music composer, was born in Lichtenthal, near Vienna, Jan. 31, 1797. His father was a school-teacher and his mother, Elizabeth Vitz, a cook; besides Franz there were thirteen children in the family. As a boy soprano he sang in the Vienna court choir, studying theory under Ruczizka and Salieri. At an early age he began to compose. His first symphony was written at the age of 16 and his first mass was finished the year following; his earliest known song bears the date Mar. 30, 1811, while some of his most famous songs, such as *Gretchen am Spinnrade* and *Erk König*, were written in his seventeenth and eighteenth years. Indeed, in 1815 he wrote no fewer than 144 songs, on some days composing as many as six. In his early twenties he taught at Count Johann Esterhazy's, but his livelihood was always precarious, since his publishers sometimes offered as little as twenty cents each for his songs and found that closing the bargain was absurdly easy. Overworked and undernourished, he was susceptible to any contagion, a fact that accounts for his short life.

Among German composers (see GERMAN MUSIC) Schubert's position is subject to less controversy than that of any of his immortal companions, perhaps because his unquestionable melodic genius seems to silence all dissension. Among melodists he has had no rival in recorded history. As a song composer he bequeathed to the world more than 600 lyrics, many of which head the list of tonal poems that are supremely lyrical, while his orchestral and pianoforte works are repeatedly touched with the same spirit of enduring beauty. *Du bist die Ruh*, the ballet music to *Rosamunde*, the *Moments musicaux* for the pianoforte, the "Unfinished" Symphony in B minor—these widely different compositions in shape and color are alike nevertheless in graceful and poetic qualities, evoked by no composer save this Keats of music.

Finally, despite criticism of him as a symphonist, his symphony in C major stands secure among the world's masterpieces in that domain. His collected works run to 40 volumes, comprising ten symphonies, twenty string quartets, a string octet, 20 pianoforte sonatas and shorter pieces, six masses, more than 600 songs, and innumerable lesser compositions, short and long, for voice, piano, and orchestra. His frail constitution was attacked by malignant typhus at the age of 31, and he died at Vienna, Nov. 19, 1828. He was buried at Währing, close to the grave of Beethoven.

BIBLIOGRAPHY.—E. Duncan, *Schubert*, 1905; W. N. Flower, *Franz Schubert, the Man and His Circle*, 1929.

SCHULTZE-DELITZSCHE, FRANZ HERMANN (1808-83), German economist and statesman, was born at Delitzsch, Saxony, Aug. 29, 1808. In 1850 he founded in Delitzsch the first cooperative societies and loan associations. He summoned the first cooperative convention and formed at Weimar a central bureau of cooperative societies. In 1861 he entered the Prussian Chamber. The Prussian law of association, enacted in 1867, was his chief work. He contributed to the uniformity of legislation and also published an important work on legislation and the status of cooperative associations. He died at Potsdam, Apr. 9, 1883.

SCHUMANN, ROBERT ALEXANDER (1810-56), German music composer, was born at Zwickau, Saxony, June 8, 1810. He began to compose at the age of seven, but in accordance with his mother's wishes that he study law, he entered the University of Leipzig in 1828. At the age of 20, however, he overcame maternal objections to a musical career, and undertook studies in theory with Heinrich Dorn, and of the pianoforte with Friedrich Wieck. It was Schumann's ambition to become a virtuoso, but in his eagerness to excel he crippled the fourth finger of his right hand while practising, and thenceforth devoted himself to composition and criticism. In 1834 he founded, with Wieck and others, the *Neue Zeitschrift für Musik*, which he edited for ten years, making it one of the leading critical journals of the time. In the meantime he fell in love with Clara Josephine Wieck (1819-96), who as Clara Schumann became one of the most brilliant pianists the world has known. Her father steadfastly opposed the match, but in 1840 the two were married. Until then almost all of Schumann's compositions had been for the pianoforte. Now he turned to song, and created some of the finest lieder in musical literature. After his marriage he also began to compose for the orchestra. In 1844 he was appointed to the music faculty of the Leipzig Conservatory, and in 1850 he succeeded Hiller as capellmeister at Düsseldorf. Periods of melancholia, which had afflicted him earlier in his life, now began to become aggravated, and in 1854 he attempted to drown himself in the Rhine. Save for occasional intervals, when his mind was lucid, Schumann remained thereafter in an asylum.

Preeminent among the German romanticists (see Music: German) by reason of a passionate intensity

that infuses not only his songs but also his pianoforte works and his chamber music, he also was a vehement worker in the field of criticism, and his early praise of both CHOPIN and BRAHMS testifies to his discernment and to the generosity of his character. Among song composers he stands in the company of Brahms and FRANZ SCHUBERT, while his pianoforte works, notably his concerto in A minor, the *Études symphoniques*, *Carnaval*, C major *Fantasie*, three romances and three sonatas have immeasurably enriched the literature of that instrument. His collected works extend to 34 volumes comprising four celebrated symphonies (in B-flat, C, E-flat, and D-minor), an opera *Genoveva*, a cantata *Das Paradies und die Peri*, a requiem, a score of a cappella choruses, nearly as many songs of incomparable beauty, three string quartets, a pianoforte quartet and quintet, music to Byron's *Manfred*, and the *Pilgrimage of the Rose*, the latter for solo, chorus, and orchestra, and the solo works for that instrument above cited. He died at Endenich, near Bonn, July 29, 1856.

BIBLIOGRAPHY.—H. Bedford, *Robert Schumann, His Life and Work*, 1925; F. Niecks, *Robert Schumann*, 1925.

SCHUMANN-HEINK, ERNESTINE (1861-), Bohemian-American contralto, was born at Lieben, near Prague, June 15, 1861. Her early training was irregular, but after making her début at Dresden at the age of 17 she studied systematically under Krebs and Wullner. At the age of 22 she joined the Hamburg State Opera, rapidly winning renown for her Wagnerian interpretations, and in 1892 she appeared at London. In 1896 she sang at the Bayreuth Festival, returning there each year for a decade, except for the years 1898, 1900, and 1903 when the Festival was not held. In 1899 she became a member of the company of the Metropolitan Opera, New York, having made her American début at Chicago on Nov. 7, 1898. After 1903 she toured extensively in recital. Her repertory of 150 rôles, combined with a voice of notable richness and unusual compass, made her one of the celebrated singers of her generation. She married three times, in 1882 to Ernst Heink, in 1893 to Paul Schumann, and in 1905 to William Rapp, Jr. In 1908 she became a citizen of the United States. During the World War two of her sons fought on the side of America and one for Germany. She devoted much of her time singing in the training camps in America. She reappeared in 1926, at the age of 64, with the Metropolitan Opera, in *Das Rheingold*, since devoting herself to teaching and concert and radio singing.

SCHURMAN, JACOB GOULD (1854-), American educator and diplomat, was born at Free-town, Prince Edward Island, Canada, May 22, 1854. He graduated from the University of London in 1877, studied at Paris and the University of Edinburgh 1877-78 and from 1878-80 at the universities of Heidelberg, Berlin and Göttingen and in Italy. He was professor of philosophy at Acadia College 1880-82 and at Dalhousie College 1882-86. From 1886-92 he was professor of philosophy at Cornell University and from 1892-1920 was president. Outstanding as an

educator, Schurman has been equally prominent in the diplomatic field. He was president of the first United States Philippine Commission in 1899, spending the greater part of the year in the Philippine Islands. From 1912-13 he was United States minister to Greece and Montenegro and from 1921-25 to China. He was ambassador to Germany 1925-29, and through his deep understanding of the people and their ready acceptance of him as a friend, was able to exert great influence in reestablishing the cordial relations between the two countries during the post-war period.

Among his other writings are *Kantian Ethics and the Ethics of Evolution*, 1881; *The Ethical Import of Darwinism*, 1888; *Philippine Affairs—A Retrospect and Outlook*, 1902; *The Balkan Wars, 1912-13, 1914*; and *Why America Is in the War*, 1917.

SCHURZ, CARL (1829-1906), German-American statesman and publicist, was born at Liblar, Prussia, on Mar. 2, 1829. After matriculating at Bonn in 1847, he was forced to flee from Germany as a result of his revolutionary activities in the uprisings of 1848-49. He emigrated to America in 1852, living first at Philadelphia and later at Madison, Wis. Here he embarked on a political career, became active in the anti-slavery movement, and rose rapidly to prominence in the Republican Party. Soon after Lincoln's inauguration, Schurz was appointed Minister to Spain, but resigned this post in Dec. 1861 to enter the Union army. As brigadier-general, then as major-general, he distinguished himself in several important battles. From 1869 to 1875 he was United States Senator from Missouri. During this period he became one of the organizers of the Liberal Republican Party, which nominated Horace Greeley for the Presidency in 1872 in an unsuccessful attempt to defeat the political forces supporting Grant. Under President Hayes he served as Secretary of the Interior, 1877-81, making a conspicuous record as a reformer in handling the patronage at his disposal. He remained active in politics until his death at New York on May 14, 1906.

An eloquent, forceful orator and a brilliant publicist, Schurz exerted an important influence in the spread of liberal ideas in America, especially among the German-speaking population. He was editor of the *Detroit Post*, the *Westliche Post* (German) and associate editor of the *New York Evening Post*, besides contributing regularly to many leading periodicals of his day. Among his numerous works were: *Abraham Lincoln*, *Henry Clay*, and *Reminiscences*.

SCHUSTER, SIR ARTHUR (1851-), British physicist, was born at Frankfort-on-Main, Sept. 12, 1851. In 1875 he was chief of an expedition sent to Siam to study the eclipse, and from 1888 to 1907 was professor of physics at Manchester where he devoted himself to spectroscopic studies. He served as president of the British Association in 1915. His chief published works include *Theory of Optics* and *The Progress of Physics*. He was knighted in 1920.

SCHUYLER, JOHN PHILIP (1733-1804), American soldier and public official, was born at Al-

bany, N.Y., Nov. 20, 1733, the scion of an aristocratic Dutch family and heir to a large fortune. During the Seven Years' War he served as an officer in the British army. As a member of the Continental Congress in 1775, he helped Washington draw up plans for the Continental army, and at the outbreak of hostilities was appointed one of the four major-generals. He was assigned to the Northern Department, but illness forced him to relinquish his command to General Richard Montgomery. In 1777 Schuyler was superseded by Gates, and in 1779 he resigned his commission. He was again a member of the Continental Congress 1778-81, and subsequently served 13 years in the state senate. As a Federalist, he was United States Senator from New York, 1789-91, and again 1797-98. Schuyler consistently advocated construction of adequate canal systems throughout the country. He died at Albany, Nov. 18, 1804, soon after the death of his son-in-law, Alexander Hamilton.

SCHUYLKILL HAVEN, a borough in Schuylkill Co., southeastern Pennsylvania, situated on the Schuylkill River, 4 mi. south of Pottsville. It is served by three railroads. The borough has planing and rolling mills, clothing, shoe and casket factories. The surrounding region is good farming country. Pop. 1920, 5,437; 1930, 6,514.

SCHUYLKILL RIVER, a river of Pennsylvania, heading in Schuylkill Co. in the east central part of the state. It flows southeastward for 112 mi. to unite with the Delaware River at Philadelphia. In its course through Schuylkill and Berks counties the river crosses several water gaps through the ridges of the Appalachian valley. The area drained is about 1,800 sq. mi. of the manufacturing and coal mining region. Pottsville, Reading, Phoenixville, Norristown and Conshohocken are situated on its course. The Schuylkill has an average fall of 5 ft. per mi. but is navigable almost to its source by means of dams and locks. In Philadelphia it affords extensive wharfage.

SCHWAB, CHARLES MICHAEL (1862-), American manufacturer and capitalist, born at Williamsburg, Pa., Feb. 18, 1862. After studies at St. Francis College, Loretta, Pa., he obtained work in 1880 as a stake-driver for the Carnegie Co., of which he became chief engineer the next year. Between 1887 and 1896, he was, successively, superintendent of the Homestead Steel Works, Homestead Works and the Edgar Thompson Steel Works, and, in 1897, was appointed president of the Carnegie Steel Co. In 1901-03, he was president of the United States Steel Corporation, resigning to obtain control of the Bethlehem Steel Corporation, of which he became chairman of the board of directors. During the World War, the Bethlehem Corporation and associated interests sold \$500,000,000 in steel products to the Allies. In April, 1918, Schwab was appointed head of the Emergency Fleet Corporation, and, after the war, returned to the Bethlehem Steel Corporation.

SCHWEIDNITZ, a German city in Prussian Lower Silesia, about 30 mi. southwest of Breslau.

The city has a parish church, founded in 1330 by Duke Bolko II, with the highest tower in Silesia, a church of the 17th century and an old rathaus with a famous cellar. The Castle Schweidnitz, residence of the first Piast dukes, was an important Silesian fortress. It was frequently besieged in the 17th century and captured by invading armies. The fortress was in the hands of the French from 1807 to 1815 and was demolished in 1867. After the fall of Napoleon I, it was returned to Prussia. Schweidnitz produces wire, metal and electro-technical goods, artificial wool, organs, gloves, leather and buttons, and trades in grain, lumber and cattle. Pop. 1925, 30,758.

SCHWEINFURT, a German city in Lower Franconia, Bavaria. It is situated on the Main River, about 30 mi. northeast of Würzburg. St. John's Church of the 14th century, a 16th century Rathaus and a library with rare manuscripts are notable. The old 10th century castle of the margraves of Schweinfurt was destroyed in 1253 in a battle between Henneberg and the Bishop of Würzburg. The new castle, built on the property of the Teutonic Order, together with the city, which was a free imperial city from 1130 to 1802, finally became Bavarian about 1803. This city manufactures machines of various sorts, ball bearings, gelatine, shoes, paints (one is known as Schweinfurt green), soap, leather, malt and other goods. There is trade in drugs, paint, wine and cattle. Schweinfurt also has horse, cattle and fruit fairs. Pop. 1925, 36,336.

SCHWERIN, capital of the German State, former grand duchy, of Mecklenburg-Schwerin, is pleasantly situated between Lake Schwerin and seven smaller lakes. It is about 130 mi. northwest of Berlin. It has fine streets and squares and many handsome buildings, among them, on an island, the former imposing grand ducal palace with beautiful gardens, built on the site of an old Slavic fortress. Originally a Slavic settlement, Schwerin was made a city by Henry the Lion in 1161, and seat of a count and a bishop six years later. It fell to Mecklenburg after the secularization of the bishopric in the 17th century. Among the churches, the Gothic cathedral, 1365-1430, is noteworthy. Trade and industry are not important, although there are various factories making pianos, machines, silverware, corks and varnish. Pop. 1925, 48,157.

SCHWOB, MARCEL (1867-1905), French writer, was born at Chaville, Aug. 23, 1867. His first work, *Études sur l'argot français*, 1889, was followed by *Coeur double*, 1891, *La Croisade des enfants*, 1895, *La lampe de Psyche*, 1903, all distinguished by a graceful, flexible style and vivid imagination. He adapted Shakespeare's *Hamlet* for Sarah Bernhardt in 1899. *Le Jargon des Coquillards' en 1455*, published 1890, contains many new and strange facts concerning FRANÇOIS VILLON. Schwob died in Paris, Feb. 12, 1905.

SCIATICA, pain along the course of the sciatic nerve, arising from three groups of causes: (1) inflammation of the structures surrounding the nerve;

(2) pressure on the nerve or roots by tumors, fractures, as the result of constipation, during pregnancy, or from hip joint disease; (3) neuralgia.

The symptoms depend to some extent upon the cause. In neuritis affecting the sciatic nerve, there is pain along the course of the nerve in the leg. The pain starts gradually, occurring first after exertion; it becomes worse and more constant. There is a tenderness over the nerve on pressure. In chronic cases there may be some wasting of the muscles.

The treatment should be directed toward the special cause and its removal. Rest in bed, with a splint for holding the leg motionless, is advisable in all cases for several days or weeks, until relief is obtained. Hot water bags and hot baths are helpful. Injections into the nerve sheath are recommended when relief cannot be obtained in other ways. Massage to strengthen the muscles is useful in chronic cases. *See also NEURITIS.* W. I. F.

SCIENCE, the broad field of knowledge which deals with the nature and characteristics of animate and inanimate matter. It is divided into two main fields, physical and biological. The first has to do with the inanimate, and the second with living matter.

Among the physical sciences may be reckoned ASTRONOMY, PHYSICS, CHEMISTRY, GEOLOGY, METEOROLOGY and their allied fields. The biological field includes BOTANY, EMBRYOLOGY and ZOÖLOGY and their allied fields. There are developing very rapidly borderline fields like PALEONTOLOGY, bio-physics, BIO-CHEMISTRY, GEO-PHYSICS and Physical Chemistry. One may say that the boundary lines between the various fields of science are becoming more and more obliterated.

MATHEMATICS lies at the foundation of all sciences. In fact, there are those who will maintain that a field of knowledge is a science only to the extent that its fundamental truths may be expressed mathematically. Mathematics may be thought of as pure and applied mathematics. In the case of applied mathematics, it becomes a mode of expressing physical and biological laws in a very concise language. In fact, what would take pages of printed matter to express verbally may be summed up in a single equation.

Some of the important fields of mathematics have been developed because of the necessity of the scientist for a mode of expression. NEWTON needed some way to express the fact that the velocity of a falling, or accelerated, body was steadily changing. Out of this necessity grew his "Fluxions" or what is to-day called CALCULUS. The development of vector analysis has had a somewhat similar experience. The story is told that when the mathematician, Hamilton, finished his book on Quaternions, he remarked, "There, thank God, that book will have no practical value." In the hands of Gibbs, some of this "impractical Quaternions" became the modern vector analysis, which has been a most important tool in physics.

Science, particularly experimental science, brings the student into immediate touch with the universe. It

is therefore one of those fields which should be emphasized in college curricula. Particularly should it receive more attention in high schools and academies. Students, as they enter college, should do so with a fundamental knowledge of physics, chemistry and zoölogy, because these fields of science form so large a part of our human knowledge and because they are basic for so many other fields of knowledge. *See also SCIENTIFIC METHOD.* S. R. W.

SCIENTIFIC MANAGEMENT is that method of business management which bases action on carefully determined facts. It has been variously termed Taylorism, efficiency engineering, modern management, industrial engineering. None of its names properly characterizes it. However, the father of this philosophy of management, F. W. Taylor, chose to call it scientific management and that term has had a more or less general acceptance.

The more critical minded find the term most unfortunate. Scientific management is not an exact science and as long as human beings remain human, it never will be. Management invariably and predominantly is concerned with the human element which cannot be reduced to rigid standards or whose actions cannot be accurately formularized. Moreover in successful management there is no substitute for good judgment and common sense.

Scientific management is scientific to the extent that factual data rather than hunch or tradition governs decisions; that the engineering and scientific method rather than rule-of-thumb practice forms the approach to the solution of problems; that a substantial foundation of principles of organization and management have been evolved and have found wide spread and time-tested application.

Scientific management is not synonymous with MASS PRODUCTION. Its application is universal. It is quite as workable in large or small establishments, in job shops as well as those producing standard products, in department stores, banks, hotels and other non-industrial enterprises as well as in manufacturing plants.

To F. W. Taylor, however, goes the credit for originating and introducing scientific management. His work began 50 years ago in the shops of the Midvale Steel Co., Nicetown, Pa. Other pioneers in the movement were H. R. Towne, H. L. Gantt, Carl Barth and F. B. Gilbreth. Taylor made the first formal presentation of his new concept of management before the American Society of Mechanical Engineers in 1903. The work of these men has been carried on, developed and expanded by numerous engineers and others until to-day it is the accepted method in the United States and is rapidly being introduced in Europe. P. E. H.

BIBLIOGRAPHY.—L. P. Alford, *Laws of Management*.

SCIENTIFIC METHOD. The Character Education Institution, Washington, D.C., has worked out a statement for scientific method, which has been approved by many successful research workers. It is repeated here verbatim:

"The scientific method necessitates intensive, systematic and persistent brain work under control against misunderstandings, superficiality and bias, and in complete loyalty to reality and the truth."

None but those having aptitude, instruction and training can be successful in the use of the scientific method of thinking.

Description of the Method. In working by the scientific method, an individual will do the following:

1. *Gather data* on the problem or within a selected field according to some adequate, sound plan by means of numerous and accurate observations made with the human senses, assisted and corrected by instruments of precision. The observations are usually with a well-defined purpose but are sometimes made to obtain general information. Observations must be recorded in definite terms and measurements and in specific statements.

2. *Classify and organize data* on the basis of similarities, variations, activities, processes, causes and results. Distinction must be made between essential and superficial characters.

3. *Generalize* to get principles and theories into tentative form. This requires the use of constructive imagination, discernment and known principles to formulate reasonable generalizations that solve the problem or explain the known facts in the selected field. Many researchers accept a mass of classified data and verified generalizations and then proceed to solve some problem by formulating hypotheses thereon and verifying these, without including general gathering of data and classification work.

4. *Verify generalizations* by controlled experiments, by tested predictions of results and by repetition of experiments and the gathering of additional data. Data should be appraised by coefficient of variation and of correlation made by probable error. The sources of error in method and apparatus must be determined and evaluated by auxiliary investigations. All assumptions should be stated and included in the conclusions.

5. *Report the research* in full and subject results to criticism and verification by others competent to collaborate.

6. *Announce the results* of the research to the general public for practical use.

Attitude. To achieve the most success in his work, the scientist should be: 1. Sincere and open-minded; not diverted by personal interests. 2. Alert and alive to truth, vital; not complacent. 3. Poised; not excitable, hysterical or melancholy. 4. Discerning and thorough; not superficial. 5. Accurate; not indefinite. 6. Inventive and constructive; not lacking initiative. 7. Independent; not suggestive. 8. Thoughtful and persistent; not merely impulsive. 9. Industrious and energetic; not lazy and dilatory. 10. Systematic; not haphazard. 11. Purposeful; not led merely by likes and dislikes. 12. Self-confident; not hesitant.

S. R. W.

SCIENTIST, a person who makes a rational or experimental study of energy, matter and mathemati-

cal relationships. He interprets his observations, attempting to arrive at conclusions as to the principles and processes of various natural or artificially produced phenomena, always checking his findings against accepted fact or theory. The work of scientists is carried on in such fields as mathematics, astronomy, physics, chemistry, biology, botany, entomology and other aspects of the physical and biological sciences. By extension, scholars working in the scientific spirit and method in other fields, such as the social and humanistic studies, are sometimes included among the scientists.

SCILLY ISLANDS, a group of 140 islets and rocks off the southwestern coast of England. The chief among them are St. Mary's, Treco, St. Martin, Bryher and St. Agnes, the only ones inhabited. The total area of the entire group is about 10 sq. mi. and the products include barley, oats, rye and potatoes. Fishing is an important industry. The capital of the group is Hugh Town in St. Mary's Island. Pop. about 2,000.

SCIOTO RIVER, a tributary of the Ohio River in Ohio; rising in Auglaize Co., it flows eastward to Marion and then southward to join the Ohio at Portsmouth. Its total length is about 200 mi. and it is navigable in high water for over half that distance. Its valley has a rich limestone soil and is highly cultivated. The cities of Columbus and Chillicothe are situated on its lower course.

SCIOTO TRAIL, a famous Indian thoroughfare which began at Ft. Sandusky, on Lake Erie, ascended the Sandusky Valley and descended the Scioto Valley to the Ohio, and continued southward through Kentucky to Cumberland Gap. It linked the Shawnee villages, and was the main route of the Virginia fur trade with the Shawnee and the Indians of upper Ohio. It had been a warpath of the northern Indians to the Cherokee country of the South. During the Revolution it became a highway of war parties, Indian and Kentuckian. At Cumberland Gap it met the Virginia Warriors' Path, the trail which, east of the gap, became the nucleus of the WILDERNESS ROAD.

SCIPIO, the name of an illustrious Roman family, of which two members gained particular distinction. Publius Cornelius Scipio, known also as Scipio Major or Scipio Africanus (237-c.183 B.C.). At the age of 19 he was present in the army of his father at the Battle of the Ticinus River in which HANNIBAL defeated the Romans. Later, 216 B.C., he fought at Cannae, shortly after which his courage in the face of defeat dissuaded a considerable group of Roman nobles from abandoning Italy to its fate. In 210 B.C. after the death of his father and uncle in Spain, although only 27 years of age, Scipio received an appointment as proconsul to conduct Rome's military operations in Spain. In the same year he captured New Carthage, and in the next three years mastered Spain almost completely. His one serious blunder was in allowing Hasdrubal to march from Spain to the relief of Hannibal, an error which Hasdrubal's de-

feat and death at the Metaurus River, 207 B.C., retrieved. Elected consul in 205 B.C. Scipio persuaded the Senate to let him take an army over to Africa. Soon the Carthaginians were compelled by the successes of Scipio to recall Hannibal, and in 202 B.C. Scipio defeated him in the decisive Battle of Zama, thereby ending the Second Punic War. Scipio's subsequent career is unimportant. An accusation brought against him in 185 B.C. for dealing too leniently with Antiochus the Great of Syria, Scipio silenced by reminding the people of the day of Zama. Publius Cornelius Scipio Africanus Minor (c. 185-129 B.C.), the son of Lucius Aemilius Paulus, who defeated the Macedonians at Pydna, 168 B.C. He was adopted as son by the son of Scipio Major. After holding a subordinate position under the consul Manilius at the siege of Carthage, 148 B.C., Scipio although below the legal age was elected consul, 147 B.C., to conduct the war, and in the following year he captured Carthage. In 133 B.C. he brought Rome's war against Numantia in Spain to a successful conclusion. In the disorder attendant upon the enforcement of the land laws of Tiberius Gracchus, Scipio, who opposed the reallocation of the land, was murdered in his sleep by an unknown assassin. Scipio was a great patron of letters and gathered in an intimate circle about him Polybius, Terence, Lucilius, Panaetius, and other Greek and Roman writers.

SCISSORS OR SHEARS, a hand tool for cutting paper, cloth and sheet metal. Scissors comprise two KNIFE blades so hinged that their cutting edges close on the material to be cut. They are also called *snips*, especially in the case of tinner's scissors. Cutting machines built on the scissors principle are called shears, and may be used to cut up scrap iron and bar stock.

SCITUATE, a town and village in Plymouth Co., southeastern Massachusetts. The village is situated on the Atlantic Ocean, about 25 mi. southeast of Boston. It is served by the New Haven Railroad. The town has lobster fisheries, and is an attractive summer resort. The principal crops are cauliflower, tomatoes and cucumbers. Scituate was incorporated in 1636. Pop. 1920, 2,534; 1930, 3,118.

SCLERODERMA. See NEUROSURGERY: Sympathetic Nerves.

SCOLLARD, CLINTON (1860-), American poet, was born at Clinton, N.Y., Sept. 18, 1860. He was educated at Hamilton College, Harvard University and at Cambridge, England. From 1888-96, he was professor of English at Hamilton College, and in 1911 resumed this position. He is the author of 31 books of poems. In 1914 the most representative pieces of his early work were published in *Poems Selected*. Scollard wrote of the World War in *The Vale of Shadows*, 1915, and in *Let the Flag Wave*, 1917. *The Crowning Years* appeared in 1929.

SCONCE, a wall bracket with two or more branches for candles or electric bulbs, commonly used

in pairs. The most primitive form was a single pricket candlestick, fixed to the wall. In the 17th and 18th centuries sconces, or *girandoles* as they were called in France, were made of highly ornamented metal or of carved and gilded gesso. English sconces of the Georgian period, which often incorporated a vase or mirror, are especially beautiful. In their extravagant carving and over-decoration those of subsequent epochs seem inferior. Sconces are extensively used in modern lighting schemes, both for local and general illumination.

SCONE, STONE OF, the ancient boulder apparently of red Scottish sandstone, which is set within the coronation chair in Westminster Abbey and is always used when a British sovereign is crowned. History records that in 850 King Kenneth MacAlpine brought the stone from Dunstaffnage Castle to the monastery of Scone. In 1297 King Edward I of England removed the stone to Westminster.

SCOPAS, one of the three great Greek sculptors of the 4th century B.C., who worked in Athens, the Peloponnesus and Asia Minor. His style was strong and massive and characterized by restrained pathos of expression. He executed the pediments of the temple of Athena Alea at Tegea, fragments of which, including four heads, have been found recently. A head of Apollo found in the Mausoleum at Halicarnassus is thought to be undoubtedly his.

SCOPOLAMINE HYDROBROMIDE, the hydrobromide of an alkaloid (levorotatory scopolamine), formula $C_{17}H_{21}O_4 \cdot NHBr \cdot 3H_2O$, obtained from the roots of *Scopolia atropoides* and others of the night-

shade family; also known as hyoscine hydrobromide. It occurs as colorless crystals, soluble in water and in alcohol. The actions of scopolamine closely resemble



WOODEN SCONCE, SHERATON STYLE (1790-1800)



COURTESY M. M. OF ART
SCONCE OF BRONZE
French, Louis XIV
Period



APOLLO WITH LYRE,
BY SCOPAS
In the Vatican

those of ATROPINE, but differ from the latter in having a sedative effect on the brain, which property is sometimes used in treatment of certain forms of insanity. A combination of scopolamine and morphine is serviceable as a preliminary anesthetic, as in so-called twilight sleep; it must be used with extreme caution. Scopolamine hydrobromide also finds wide use as a mydriatic (dilating the pupil of the eye in ophthalmologic practice).

P.N.L.

SCORIA, a cellular, froth-like crust of rock often formed on the surface of cooling basaltic LAVA flows, and also ejected during volcanic eruptions. It is somewhat glassy, but partly stony, of a black to red color, closely resembling ordinary furnace clinker and cinders. Scoria, like PUMICE, is produced by the expansion and escape of vapors from the molten material as it reaches the surface. *See also* BASALT; PETROLOGY; IGNEOUS ROCKS; VOLCANISM.

SCORPION, the name for members of an order, *Scorpiones*, of arachnids, distantly related to spiders. They are found almost everywhere in warm countries. In the United States there are numerous species in the

brought forward over the back, and the victim is soon still. The poison is very strong and its effects on man may be very unpleasant, though they are seldom fatal.

During the day scorpions usually hide under rocks or in other dark corners. They do most of their hunting at night. Insects and spiders are their ordinary prey, though some of the larger species kill lizards and mice. The young develop within the female's body. In the Languedoc scorpions, which have been carefully studied, the babies are born enclosed in the egg case, which the mother solicitously removes, and they ride on her back for a period of time.

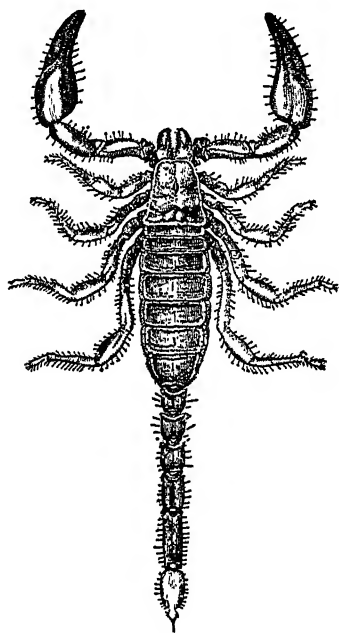
A.I.W.

SCORPION-FLY, an insect of the order *Mecoptera*. Winged adults possess four long, narrow membranous wings. Several species are wingless. The head is prolonged into a downward-turned beak, at the end of which are the chewing mouth-parts. Metamorphosis is complete. Larvæ resemble caterpillars and are carnivorous. In those species whose life history is known, eggs are laid in the ground. Pupation occurs in the ground. Adults of the genus *Bittacus* resemble crane-flies. When at rest, they hang suspended by their legs from some support. They feed on living insects.

SCORPIUS (gen. *Scorpii*), the eighth constellation of the Zodiac, is the only one where the alignment of the stars actually suggests the form of the animal it represents. It is one of the most brilliant constellations in the sky though unfortunately too far south to be seen in all its splendor from the United States, where it stands low above the southern horizon during summer evenings. Scorpius contains a wealth of bright stars mostly blue in color and intensely luminous, from 1000 to 20,000 times brighter than the sun.

Alpha Scorpii, ANTARES, is of the first magnitude, red in color, and the largest star now known. The stars Beta and Mu Scorpii, both of the third magnitude, are SPECTROSCOPIC BINARIES. The former consists of two stars, each 400 times brighter than the sun, revolving in 7 days at a distance of 19 million miles from each other. For the latter the corresponding figures are 650 and 500 times brighter, 1.45 days and some 6 million miles. In this last case the relative velocity of the two stars is no less than 300 miles per second. The fourth magnitude stars Xi and Nu Scorpii are multiple, the former being triple, the latter quadruple. The tail of the Scorpion lies in the Milky Way, and the constellation abounds therefore in VARIABLE STARS and NOVAE. Among the latter is the new star of 827 A.D., which was reported to have been as bright as the moon. *See* STAR: map. W. J. L.

SCORZONERA, a genus of plants of the composite family comprising about 100 species native to the Old World. They are perennial or rarely annual herbs with narrow, usually entire leaves, and long-stalked heads of yellow flowers. The black salsify (*S. hispanica*) is cultivated, especially in Europe where it is native, for its fleshy, black-skinned taproot, used as a vegetable and for its leaves which are eaten as a salad.



SCORPION
Centruroides phaeodactylus

South; others occur as far north as Idaho and Nebraska.

A scorpion looks a little like the product of a cross between an insect and a lobster. It has a pair of small pincers near the mouth, and a pair of large pincers, like lobster claws, back of them. There are four pairs of walking legs. Its poisonous sting is located at the tip of a long, flexible tail. Contrary to the usual belief, the sting is used only when necessary. If a large insect, for example, is struggling violently and seems likely to escape from the scorpion's claws, the sting is

SCOTER, a small genus (*Melanitta*) comprising six species of diving ducks found in the colder parts of the Northern Hemisphere. They are characterized by having a large bill, usually greatly swollen at the base, and almost uniform black plumage in the male, and plain brownish black in the female. They feed chiefly upon small mollusks, which they obtain by diving, and nest on the ground near water or in marshes. The North American species, which are slightly smaller than the mallard, include the American scoter (*M. americana*), which breeds in the North but winters southward to California and the south-eastern states; the surf scoter (*M. perspicillata*), and the white-winged scoter (*M. deglandi*), of similar range.

SCOTIA, a village in Schenectady Co., eastern New York, situated on the State Barge Canal, 1 mi. from Schenectady, of which it is a residential suburb. The Schenectady Airport adjoins the village, which is served by three railroads. Scotia is beautifully situated in a good farming region between the Adirondack and the Catskill mountains. It was the concentration point during the French and Indian Revolution and the War of 1812. The village was incorporated in 1902. Pop. 1920, 4,358; 1930, 7,437.

SCOTLAND, a political division of the United Kingdom, occupying that portion of the island of Great Britain north of the English boundary; it also comprises the Orkney and Shetland islands off the north coast, and the Hebrides and other islands off the west coast. Separated from England substantially by the Solway, the Cheviot Hills and the Tweed, it is bounded on the north and west by the Atlantic Ocean

and on the east by the North Sea. The greatest length is 274 mi.; the breadth varies from about 150 mi. to less than 30. But few points on the mainland are situated more than 40 mi. distant from the sea, the country being deeply indented by numerous inlets. The total area is 29,796 sq. mi., exclusive of inland waters, 608 sq. mi. For political purposes the country is divided into 33 shires or counties.

Physical Features. By the nature of its surface the country is divisible into the highlands of the north, the southern uplands and the central lowlands. The Scottish highlands are westward extensions of the Scandinavian mountains and, like them, are a rugged mass of ancient crystalline rocks, dissected by water and ice, which show marked relief, in some areas as much as 2,000 ft. A narrow gash, Glen More, indicates a northeast-southwest fault, south of which the highlands are known as the Grampians. The eastern and western coasts of the highlands are in marked contrast. The latter is made up of bold rocky headlands deeply indented by fjords and bordered by numerous rocky islands. The general slope of the highlands is eastward, providing on the North Sea coast a narrow, although practically continuous, coastal plain. The interior of the highlands is of little economic value. The rocky slopes are mostly treeless, bog and heather covering the lower parts, while above they are practically bare. The southern uplands differ in several respects from the highlands with which they were formerly continuous. They occupy a much smaller area and their relief is much more subdued. The Scottish lowlands occupy a graben valley which separates the highlands from the uplands. The sedimentary rocks and coal beds, whose settling made this structural valley, were thus preserved from the rapid erosion which removed the rest of the same formations from the structurally higher elevation on either side. A level topography, fairly fertile soil, with deposits of coal and iron, have enabled three-fourths of the people of Scotland to make this depression their home. The firths of Clyde and Forth almost meet here, less than 30 mi. separating their heads. An additional subsidence of less than 100 ft. would turn the lowland into a strait.

Rivers and Lakes. Most of the chief rivers flow to the east to enter the North Sea, the largest being the **TWEED**, **Tay**, **FORTH**, **Don**, **Spey** and **Deveron**; those entering the Atlantic are the **CLYDE**, **Ayr**, **Doon** and **Dec**. The Clyde carries a vast traffic from **GLASGOW** downwards, this being rendered possible by artificial deepening. There are numerous lakes which, like the inlets, are called lochs. Many of them look like expansions of rivers and are long and narrow in shape. Among the largest are **LOMOND** with 28 sq. mi., **Ness**, **Tay**, **Shin**, **Awe** and **Maree**. **Loch Katrine**, though comparatively small, is noted for its beautiful surroundings. It is in the district called the **Trossachs**, a place of beautiful glens of gray birches, mountain crags, green oak copses, and a luxuriant growth of ferns, mosses and flowers. The lakes attract many tourists.

Civil Counties	Pop. 1921	Pop. 1931
Shetland	25,520	21,410
Orkney	24,111	22,075
Caithness	28,285	25,656
Sutherland	17,802	16,100
Ross and Cromarty	70,818	62,802
Inverness	82,455	82,082
Nairn	8,790	8,294
Moray	41,558	40,805
Banff	57,298	54,835
Aberdeen	301,016	300,403
Kincardine	41,779	39,864
Forfar	271,052	270,190
Perth	125,505	120,772
Fife	292,925	276,261
Kinross	7,963	7,454
Clackmannan	52,542	31,947
Stirling	161,719	166,447
Dunbarton	150,861	147,751
Argyll	76,862	63,014
Bute	55,711	18,822
Renfrew	298,904	288,575
Ayr	299,275	285,182
Lanark	1,539,442	1,585,968
West Lothian	85,962	81,426
Midlothian	506,377	526,277
East Lothian	47,487	47,369
Berwick	28,246	26,601
Peebles	15,552	15,050
Selkirk	22,607	22,608
Roxburgh	44,989	45,787
Dumfries	75,570	81,060
Kirkcudbright	57,155	30,341
Wigtown	50,785	29,299

SCOTLAND

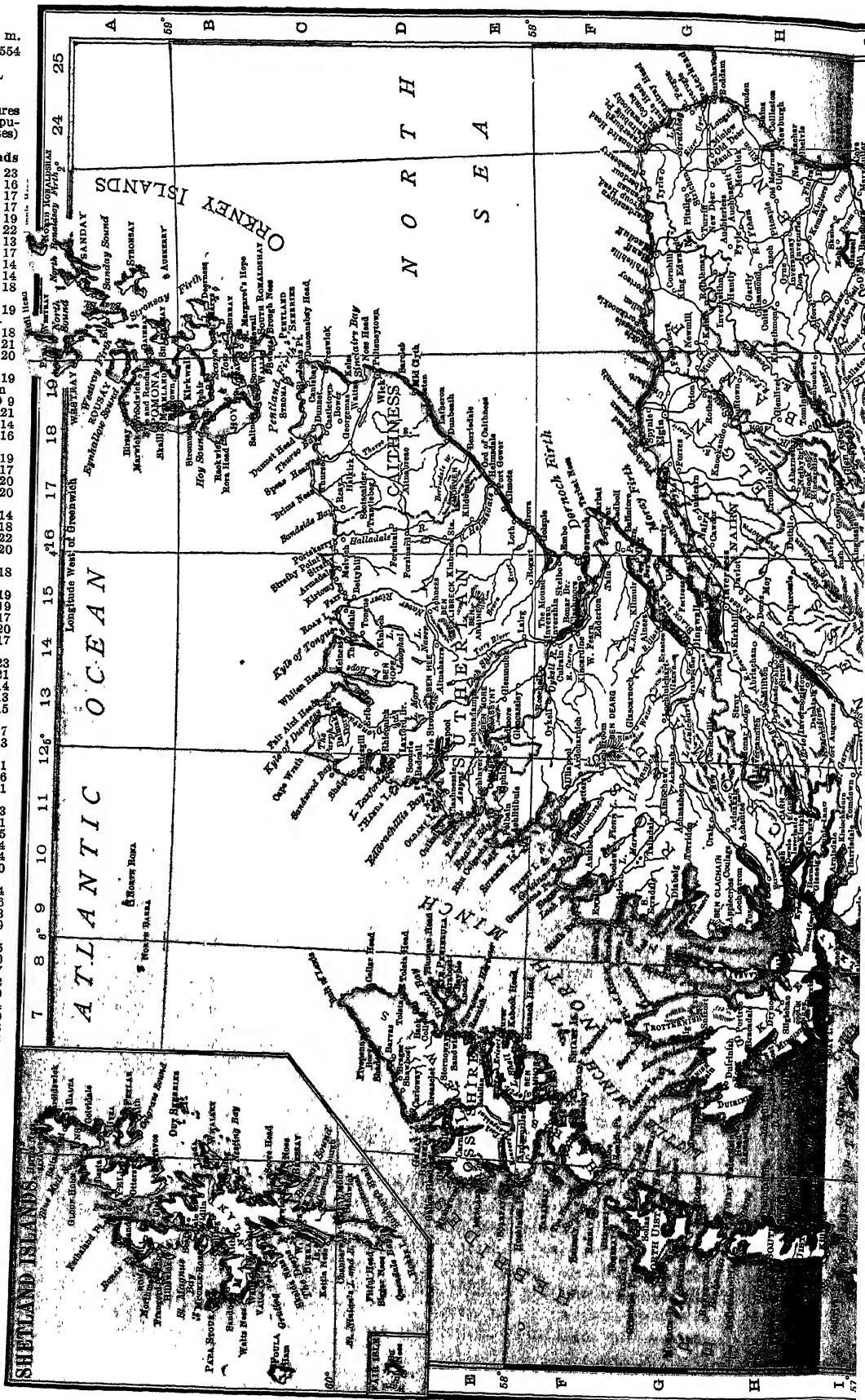
Area 30,405 sq. m.
Pop. 4,842,554

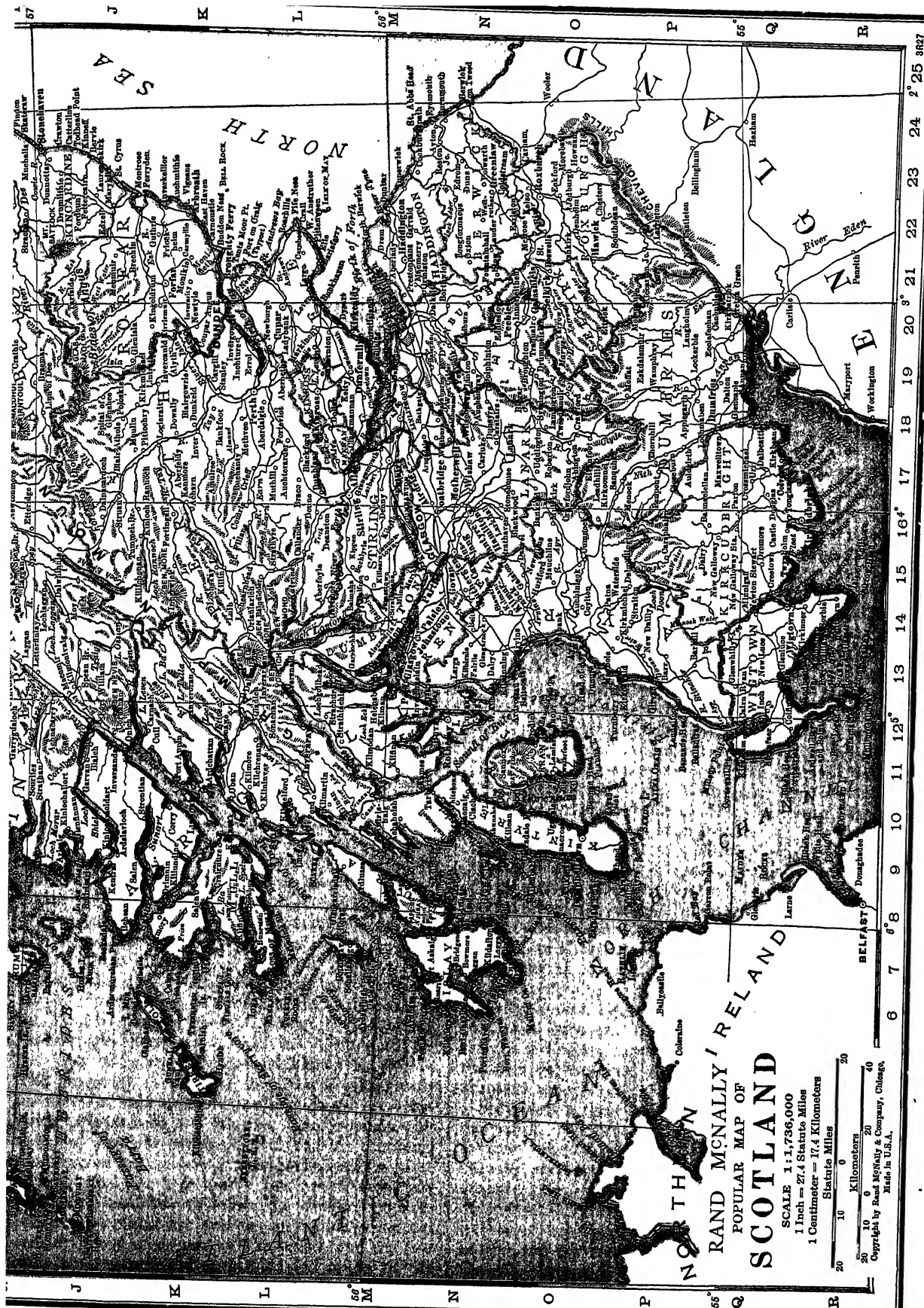
PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands

187 Aberdeen	I 23
26 Airdrie	... N 16
18 Alloa	... M 17
5 Alva	... L 17
6 Annan	... Q 19
18 Arbroath	... K 22
14 Ardrossan	... O 13
5 Armadale	... M 17
40 Ayr	... O 14
12 Barrhead	... N 14
18 Bathgate	... M 18
5 Blairgowrie	... K 19
10 Borrowstounness	... M 18
8 Brechin	... J 21
9 Buckie	... G 20
6 Burntisland	... M 19
6 Campbeltown	... M 19
5 Carnoustie	... K 21
47 Clydebank	... M 14
32 Coatbridge	... N 16
13 Cowdenbeath	... M 19
6 Crieff	... L 17
5 Cupar	... L 20
8 Dalkeith	... M 20
22 Dumbarton	... M 14
19 Dumfries	... Q 18
5 Dunbar	... M 22
176 Dundee	... K 20
41 Dunfermline	... M 18
439 Edinburgh	... M 19
10 Elgin	... G 19
38 Falkirk	... M 17
11 Forfar	... K 20
5 Forres	... G 17
10 Fraserburgh	... M 17
13 Galashiels	... O 21
6 Galston	... O 14
6 Girvan	... P 13
1088 Glasgow	... N 15
21 Grangemouth	... M 17
79 Greenock	... M 13
6 Haddington	... M 21
44 Hamilton	... N 16
18 Hawick	... O 21
9 Helensburgh	... M 13
5 Huntly	... G 21
23 Inverness	... H 15
8 Irvine	... O 14
3 Johnstone	... N 14
6 Keith	... G 20
36 Kilmarnock	... O 14
10 Kilsyth	... M 16
9 Kilwinning	... N 13
46 Kirkcaldy	... M 19
17 Kirkintilloch	... N 15
5 Kirriemuir	... K 20
9 Lanark	... N 17
9 Largs	... N 12
80 Leith	... M 19
6 Lerwick	... C 4
7 Leven	... L 20
7 Lighthgowm	... M 18
6 Maybole	... N 13
5 Melrose	... O 21
5 Milngavie	... M 15
12 Montrose	... J 22
65 Motherwell	... N 16
17 Musselburgh	... M 20
5 Nairn	... G 16
6 Oban	... L 10
120 Paisley	... N 14
6 Peebles	... N 19
5 Penicuik	... N 19
35 Perth	... L 18
15 Peterhead	... G 25
20 Port Glasgow	... M 13
9 Rothesay	... N 12
25 Rutherglen	... N 15
8 St. Andrews	... L 21
7 Sellckirk	... O 21
23 Stirling	... M 16
4 Stornoway	... N 7
6 Stranraer	... O 12
4 Thurso	... C 18
4 Turriff	... G 22
10 Wick	... D 19





**RAND McNALLY'S
POPULAR MAP OF
SCOTLAND**

SCALE 1:1,736,000
1 inch = 27.4 Statute Miles
1 Centimeter = 17.4 Kilometers

Statute Miles
0 10 20
Kilometers
0 20 40
Copyright by Rand McNally & Company, Chicago,
Made in U.S.A.

Climate. In summer the temperature of Britain diminishes northward from London to the north of Scotland. The summer temperature in the southern half of Scotland varies between 58° and 59° F., and is about 4° lower than in England. In winter the temperature of Britain diminishes from west to east, that is, away from the Atlantic and west winds. These winds sometimes bring a heavy snowfall to the interior of the country. The winter climate of a great part of Scotland may be described as raw. Mists and rain are prevalent. The west winds bring a heavy rainfall to the high western border. Although the rainfall is heaviest in winter, it persists with considerable frequency during summer. The east coast, lying in the lee of the mountains, is much drier.

Minerals. The Firth and Clyde coal fields occur in the graben valley forming the Scottish lowlands. Coal measures originally covered three times as much of southern Scotland as are comprised in this field, but erosion removed the bulk of them. The output of these fields approximates 35,000,000 tons annually, supporting an extensive industrial life. A considerable amount of coal is also exported to Ireland, the industries of Belfast deriving their coal supply from the Ayreshire fields. The hills and mountains naturally supply abundance of building stone. Stone has constantly been quarried for use as a building material from the earliest times. Of its use in early times the vitrified forts and the curious round towers known as *brochs* survive as witnesses in many parts of the country. Granite forms a considerable article of export trade, principally from ABERDEEN and Peterhead. Iron occurs as carboniferous bedded ores, but the output is insufficient and large quantities of iron ore are imported. Other important minerals are fire-clay, oil-yielding coal and bituminous shale.

Agriculture. On account of the rugged nature of the surface only about 25% of the acreage is in crops and grass. Oats is by far the most important cereal. Barley is grown extensively, but the wheat area is insignificant. Potatoes, turnips and beans are largely cultivated. In recent years there has been an increase in the area under grass. Sheep-raising is a leading feature of rural industry; in 1929 there were over 7,500,000 special breeds, including the fine-wooled Shetland.

Manufactures. Woolen manufactures form the staple industry chiefly in certain towns in the basin of the Tweed including HAWICK, Jedburgh, GALASHIELS, SELKIRK and Innerleithen, which are chiefly noted for the kind of fabric appropriately known as tweeds. The prosperity of some of these towns was greatly promoted at one time by the abundance of water-power afforded by the streams, but nowadays this source of power is not much used, and the continued prosperity of the industry of the district is all the more striking from the fact that it lies remote from any productive coalfield. Though the counties of Roxburgh and Selkirk are said to carry more sheep per acre than any other part of the world, and the fact must have contributed greatly to the origin of the

industry, the local supplies of wool no longer meet a tenth of the requirements. Besides tweeds, woolen hosiery is a large manufacture of this district. Hosiery is made also at DUMFRIES, EDINBURGH and elsewhere, and carpets and other woolen goods at Glasgow, Ayr, Kilwarnock, PERTH and STIRLING. The chief center of the linen manufacture of Scotland is DUNDEE, but there, as well as in Arbroath and Montrose, it is chiefly the coarser linens that are manufactured. DUNFERMLINE has been noted for its damask table linens since the early part of the 18th century. Jute yarns and tissues, though mainly exported from London, Liverpool and Glasgow, are still manufactured most largely at Dundee, where the industry was first introduced in Britain. The operatives in the flax, jute and hemp industry of Dundee number over 55,000. Paisley is famous for its fine sewing threads. Other large industries are shipbuilding, the Clyde leading the world in this industry; distilling and paper manufacture.

Communications. The northern half of the country has hills and mountains so closely packed together that even yet there are few roads leading through the narrow and sparsely peopled valleys between them. The chief obstructions to communications offered by water are overcome by two of the most remarkable railway bridges in the world, the Tay bridge at Dundee (3,593 yds.), opened in 1887, and the Forth bridge near Edinburgh (2,765 yds.), opened in 1890. The most important canal is the Forth and Clyde Canal, which enables small sea-going vessels to pass from Grangemouth on the Firth of Forth to a place on the Firth of Clyde a little above Dumbarton. It has been proposed to replace this canal by one deep enough for large ocean vessels. A ship canal with a minimum depth of 17 ft. has been constructed through Glen More valley and connects Loch Linnhe and Loch Ness. This Caledonian Canal, noteworthy as a work of engineering, is not much used for the purpose for which it was designed, namely, to allow ships of moderate size to avoid the stormy passage through Pentland Firth. The short Crinan Canal allows small steamers to pass from the Clyde to the west of Argyllshire without passing round the Mull of Kintyre. There are networks of railways in the central and southern counties and one branch is continued to the most northern towns.

Religion and Education. There is not so close a connection between Church and State in Scotland as there is in England; the Church of Scotland is Presbyterian in doctrine and in form of government. The ministers and elders of each *kirk* form the kirk-session, a body with authority over the kirk and throughout the parish. Parishes are grouped under presbyteries; to these councils each parish is entitled to send its minister and one elder. The presbyteries again are grouped into synods. Surmounting all is the General Assembly. This is held annually in Edinburgh. It consists of representatives from all presbyteries, royal burghs and universities in the country. The Roman Catholic Church is relatively stronger here than in

SCOTLAND

England. The Scottish universities at St. Andrews, founded 1411, Glasgow, 1450, Aberdeen, 1494, and Edinburgh, 1582, have provided most of the leadership in that country—church, local government, law, medicine and journalism. Some of these leaders have extended their influence throughout Great Britain and the empire. In England, until recently only a very small proportion of the youth of the country have entered the universities of Oxford and Cambridge; in Scotland, class distinctions in education being much weaker, the costs of university education being much less, and the Carnegie grants being available for scholarships, students from all classes have had university education. There are about 2,900 schools with 864,838 pupils for elementary education, which is compulsory. The school age limit was raised from 14 years to 15 in 1931.

Population. The Scots on the average are among the tallest people of Europe. North of the base of the Grampian Hills they are largely of Celtic origin, but south of Edinburgh there is a marked infusion of Saxon blood. The population in 1931 was 4,842,554. The largest city is Glasgow, pop. 1931, 1,088,417. Edinburgh, the capital, had a population of 438,998; Dundee, 175,933; Aberdeen, 167,259. Other cities with a population over 40,000 are PAISLEY, GREENOCK, Motherwell, Coathridge and Clydebank.

H. A. A.

SCOTLAND, HISTORY OF. The story of Scotland opens in the years 78 to 84 A.D. During this period, Agricola, the Roman general, completed the conquest of southern Britain but was unable to subdue the wild tribesmen in the remote north of the island. As a defense against these natives, Agricola built a line of forts between the firths of Clyde and Forth. In 121 the Emperor Hadrian added his famous wall, connecting the River Tyne and the Solway Firth. To the unconquered natives, the Romans applied the term, Caledonians, apparently Celtic in derivation, which may mean either "men of the woods" or "men of the thistle." To-day the thistle, as the national emblem of Scotland is associated with the English rose and the Irish shamrock in heraldic devices. The Order of the Thistle, ranking next to the Order of the Garter, was founded in 1687. The Caledonians were also called Picts, a word derived from Latin and meaning "painted men."

The highlanders were turbulent, and in 208 the Emperor Severus attempted their subjugation. But three years later, he died at York. On the withdrawal of the Roman legions from Britain in 401, Caledonia, like the rest of the island, was condemned to prolonged chaos. The Norsemen swept the seaboard, holding the Orkney and Shetland islands and even the Hebrides to the west. About the year 500, the Irish also began to send forth invaders, and these aggressors were called Scots. Landing on the west coast of Caledonia, they drove the Picts to the east. It was only after three centuries of turmoil that the marriage of Aycha IV, King of Scots, to Urgaria, sister of Ungus, King of Picts, suggested a prospect

of unity. In 842 their grandson, Kenneth MacAlpine, defeated Wrad, the last of the Pictish monarchs, at Forteviot. *See* SCONE, STONE OF.

It was from Ireland also that Scotland derived her religion. In 563 the Celtic saint Columba founded a monastery on the island of Iona which became a center of missionary enterprise throughout the whole of northern Britain. The Scottish dynasty, though fierce in its family feuds, accepted the faith, and it was after promising on his knees to build a cathedral that Malcolm II, in 1010, drove off the Danes. He was grandfather of his successor, Duncan, whose death at the hand of Macbeth in 1040 is the subject of Shakespeare's great tragedy. The usurper reigned with ability until 1057, when he was defeated at Dunsinane near Perth by Duncan's son, Malcolm III, and slain at Lumphanan.

Close Association With England. As an exile, Malcolm III had spent much of his time at the cultured and ecclesiastical court of Edward the Confessor in London. After the Battle of Hastings in 1066, when William the Conqueror ascended the English throne, Edgar Atheling, the Saxon claimant, took refuge, therefore, with Malcolm who married Edgar's sister, honored by all Scots as St. Margaret. Many Saxons settled in Scotland and, for the first time, the country was brought into intimate touch with the feudal civilization of Europe. In 1100 Henry I of England married Margaret's daughter, Matilda, so uniting the royal blood of Saxons and Normans, and drawing England and Scotland into closer association. The rival kingdoms, in their development, absorbed two principalities that lay between them, namely, Strathclyde on the west and Northumbria on the east whose King Edwin founded Edinburgh about 617. In 1090 onwards, William Rufus built Newcastle-on-Tyne and Carlisle as fortresses. So were determined those borders which were frequently laid waste by armed forces and celebrated in the ballads of Scottish minstrelsy.

The Scottish kings had to render fealty to English kings for lands that they had received, which obligation was strictly enforced by William the Conqueror and, as a rule, by his successors. Under King Stephen, England was rent by civil war, and David I of Scotland, 1124-53, the founder of Melrose, Jedburgh and other abbeys, marched southwards across the border. But in 1138 he was defeated near Northallerton at the Battle of the Standard, so called because the English fought around a wheeled carriage on which were uplifted their sacred flags. In 1153 David was succeeded by Malcolm IV, his grandson, called the Maiden.

Alliance With France. William the Lion, 1165-1214, brother of Malcolm, owes his name to the fact that he adopted the red lion of Scotland as the armorial bearing on his shield. Anxious to throw off the English tutelage, he inaugurated in 1173 that alliance with France which became so important a factor in Scottish history. Next year, however, this king was captured by the English at Alnwick, and

under pressure, he agreed to the Treaty of Falaise by which Scotland became a feudal dependency of England. In 1189 Richard Coeur de Lion, contemplating a long absence on crusade, released William the Lion from these drastic terms. In 1214 William was succeeded by his son Alexander II.

The young King Alexander III, 1249-86, successfully resisted in 1263 an invasion by King Haco of Norway who landed a powerful force on the Clyde. Peace was made on terms very advantageous to Alexander. Norway ceded the Hebrides to Scotland and also sold the Orkney and Shetland Islands for 4,000 marks and a quit rent of 100 marks a year. Nor was this all. Alexander had married Margaret, daughter of Henry III, of England, and by her, he had a daughter also called Margaret. In 1281 this second Margaret was married to young King Eric of Norway. Their child, a third Margaret, was known as the Maid of Norway, and when, in 1286, Alexander III was killed by a fall from his horse, the princess, his granddaughter, became Queen of Scotland. Great were the lamentations when the Maid died on board the ship that in 1290 was bringing her from Norway to her throne.

Struggle Against English Dominance. The King of England was Edward I, and this masterful monarch had subdued Wales. He now saw his chance to be, as his epitaph puts it, "the hammer of the Scots." Standing on his rights as suzerain, he summoned the numerous claimants to the Scottish throne to appear before him at Norham. Two rivals were conspicuous. Both were descended from David, Earl of Huntingdon, younger brother of William the Lion. John Balliol, a Norman noble, whose family founded the famous college at Oxford, was grandson of David's elder daughter, Margaret. Robert Bruce (to be distinguished from his illustrious grandson) was son of David's younger daughter, Isabella. It was decided that Balliol had the prior claim to the throne. But Edward did not intend that any Scot should be king save in name. Balliol was humiliated by summonses to appear before English courts in London, and when, relying on France, he resisted these encroachments on his sovereignty, 1296, Edward marched north, besieged and captured Berwick, where 17,000 inhabitants were put to the sword, and routed the Scottish army at Dunbar. With Scotland thus reduced to a province, she found a champion in WILLIAM WALLACE. In 1297 this great patriot, obscure in origin but heroic in courage, defeated the English near Stirling and, crossing the border, ravaged England herself. But in July 1298, Wallace was defeated at Falkirk by Edward, commanding the English army in person, and in 1303, after a prolonged struggle, Wallace was captured, carried in chains to Westminster, crowned with oak leaves as an outlaw, and beheaded.

Two other actors now appear in the drama. The first was a nephew of Balliol, called John or "the Red" Comyn, who was declared Regent for his uncle. The second was ROBERT BRUCE, grandson of the

earlier claimant to the throne. In a church at Dumfries, these leaders met alone, 1306, and Bruce, possibly enraged by Comyn's subservience to Edward, stabbed his rival with a dagger. Although Bruce was hastily crowned at Scone, many of his adherents were executed, and if his prospects brightened, it was because Edward, while on his way to Scotland, died at Burgh-on-Sands near Carlisle, 1307. He was succeeded by his less vigorous son, Edward II, who did not invade Scotland until 1314 when, outside Stirling, he suffered an overwhelming defeat at the Battle of Bannockburn. Four years later Bruce recaptured Berwick and, by the Peace of Northampton, in 1328, the complete independence of Scotland was recognized.

Early Stuart Kings. Next year Bruce died, leaving a son of five years to succeed him as David II. Already the infant David was married to Joanna, daughter of the English Edward II, which meant that David and Edward III were brothers-in-law. Landing in Fifeshire, Edward Balliol, son of John, the claimant, defeated David's army in 1332 at Dupplin Moor, and the younger Balliol was crowned at Scone. Balliol was expelled in 1332; but next year, the Scots, as allies of France, invaded England and were defeated at Halidon Hill. David and his Queen were sent to France for safety. Balliol, who had submitted himself completely to English suzerainty, thus returned but was again expelled in 1334. In 1335 Edward III invaded Scotland with Balliol, but withdrew to make war with France. David II was thus brought home in 1341 but proved to be a weak king. In 1346 he was defeated by the English at Neville's Cross and taken prisoner, remaining in England for 11 years. Having no child, he outraged the pride of the Scots Parliament by proposing that the Crown should be surrendered to Lionel, Duke of Clarence, son of Edward III. A very different succession to the throne was arranged. The office of Steward in Scotland was hereditary, in the Norman family of Fitz Alan. The sixth Steward married Marjorie, daughter of Bruce and sister of David II. The seventh Steward was thus David's nephew and he succeeded his uncle in 1371 as Robert II, the first of the Stewart or Stuart sovereigns. He was succeeded by his son, Robert III.

From one generation to another, frontier wars were waged with an almost inconceivable ferocity. In 1388 the Scots won the Battle of Otterbourne but suffered serious defeat at Homildon Hill 14 years later. Internal disorders added to the miseries of the people, and from time to time there were periods of regency. But the founding of St. Andrews University in 1411, the increasing authority of the Scots Parliament, the adoption of settled laws and the growth of trade, especially in the Lowlands, meant that, amid confusion, Scotland was moving towards an ordered civilization. Captured at sea in 1405, James I, son of Robert III, was a prisoner in England when, next year, he succeeded to the throne. During his exile, he received an admirable education and, returning to

Scotland in 1424, set himself to curb the nobles, a necessary but dangerous task. In 1436 he was at Perth, near the still restless Highlands when armed conspirators surrounded his apartments. By an oft-painted act of heroism, Katherine Douglas, a lady-in-waiting, barred the door by thrusting her arm through the staples, and the king hid in a vault. But when attempting to escape, he was murdered.

James I was succeeded by his son James II, whose son James III ascended the throne in 1460, being followed by his son James IV in 1488. Five years later, the fourth James married Margaret, daughter of the English and Tudor sovereign, Henry VII. It was by this union that the Stuart dynasty at a later date was extended to England. French diplomacy involved James IV in renewed conflict with England, and on the field of Flodden, he was slain, in 1503, sharing that fate with 12 earls, 13 lords, 50 chiefs and knights and 10,000 soldiers. Born at Linlithgow in 1512, James V, in succeeding his father, was only 18 months old. In 1537 he married Magdalene, daughter of Francis I of France, on whose death next year, James married Mary of Guise. Overcome by the shame of a panic which seized the Scottish forces on Solway Moss, the fifth James died in 1542. His only child was a daughter, just a week old, who inherited the throne as MARY, QUEEN OF SCOTS.

Mary, Queen of Scots. Within a year, the hand of this ill-fated infant was pledged by treaty to the young prince who reigned over England as Edward VI. But the Scots Parliament raised objection to the match. In 1547, therefore, the Protector Somerset, anxious to enforce this treaty, defeated the Scots at the Battle of Pinkie. The young Queen was sent next year to France, the land of her mother, where she was married in 1558 to the Dauphin, afterwards Francis II. On his death in 1560, Mary returned to Scotland where, as a devout Catholic, she was confronted by JOHN KNOX and the Reformation which had converted the nation to the Presbyterian faith. A reign which opened auspiciously was terminated in 1568 by Mary's flight to England where she was held a prisoner. In 1586 a reluctant Queen Elizabeth signed Mary's death warrant, and she was executed at Fotheringhay Castle.

Union of Scotland and England. By her second husband, Henry Darnley, Mary had a son, James VI of Scotland, born in 1566. Being the great-grandson of Margaret, daughter of Henry VII, he ascended the throne of England as James I. The two Crowns, so long rival, were at last united.

The attempt of Archbishop Laud in 1637 to impose the English Prayer Book on Scotland led to armed resistance, and in 1643 the Scots signed the famous Solemn League and Covenant with the English Parliamentarians who were resisting Charles I. After the execution of that monarch in 1649 the Scottish royalists were very unwilling to accept the Commonwealth, and in 1650 Cromwell inflicted on them the crushing defeat of Dunbar, also capturing Edinburgh. Even so, Charles II was crowned at Scone

in Jan. 1651 and marched a Scottish army to Worcester, where he was defeated and driven into exile. Three years later, free trade was established between England and Scotland.

After the Restoration of the throne in 1661, the Covenanters or extreme Presbyterians, chiefly in Gallo-way, resisted attempts to impose episcopacy and in 1679 were suppressed by Graham of Claverhouse with brutal violence. In 1685 a Highland rebellion was crushed, and its leader, Argyll, executed. After the English Revolution of 1687, the supporters of the exiled James II held Edinburgh Castle for a brief period, and in 1691 military measures were proclaimed by William and Mary against all who had not laid down their arms. Next year, these measures included the treacherous massacre of highlanders at Glencoe by British troops.

After prolonged discussion, the Scottish and English parliaments were united in 1707. Seven years later, Scotland as a whole accepted the Hanoverian sovereign, George I, who displaced the Stuart dynasty. But there were two insurrections. In 1715 the Highlands rose in favor of the Young Pretender, James, son of James II, and in 1745 there was a similar rising in favor of the Young Pretender, Charles Edward. Both rebellions failed, and in 1788 the Young Pretender died. His brother, Henry, a Cardinal, lived until 1807. To-day Scotland retains her own peerage, legal system, and establishment of religion which is strictly Presbyterian. P. W. W.

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SCOTS LAW, the law of Scotland, feudal as to land, and in other respects based upon the Roman law received in Scotland through the setting up of the Court of Session in 1532. Since the union of Scotland with England in the 17th century, the fact that Scotch decisions have been reviewed at Westminster by the House of Lords has more and more tended to break down the Roman features of Scotch law or assimilate them to English law. Also British legislation affecting both England and Scotland has had similar effect. Hence the difference between Scotch law and English law is often little more than one of terminology. But Scotch procedure is a civil law procedure in distinction from the procedure obtaining in England, and on many subjects Scotch law is more like that which obtains on the Continent of Europe than like English law.

SCOTT, SIR GILES GILBERT (1880-), English architect, grandson of the noted architect, Sir George Gilbert Scott, was born Nov. 9, 1880. He was educated at Beaumont College, Old Windsor, and began the practice of architecture in London in 1902. The Cathedral at Liverpool was erected according to his designs. Other works include the Church of the Annunciation, Bournemouth; new chapel, Charterhouse School; new nave, Downside Abbey; restoration works, Chester Cathedral; St. Paul's Church, Derby Lane, Liverpool; War Me-

morial Chapel; St. Michael's, Chester Square; and new buildings at Clare College, Cambridge. Scott was knighted in 1924.

SCOTT, ROBERT FALCON (1868-1912), English Antarctic explorer, was born at Outlands, Devonport, June 6, 1868. He joined the British navy, and in 1900 was placed in charge of the National Antarctic Expedition, and given command of the ship *Discovery*. He discovered King Edward VII. Land and reached the record southern latitude of 82° 17'. In recognition of his work, Scott was made a captain, the youngest in the British navy. In June 1910 he again set out for the Antarctic commanding an expedition financed largely by the British government. Scott and four members of this expedition traveled 1,842 mi. by sledge, and reached the South Pole, Jan. 18, 1912, 35 days after AMUNDSEN. On the way back, the five men were delayed by terrific weather and by the geological specimens they were carrying. Two dropped by the way and finally Scott and his two remaining companions died about Mar. 27, 1912.

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SCOTT, SIR WALTER (1771-1832), Scottish poet and novelist, was born at Edinburgh, Aug. 15, 1771, the fourth surviving child of Walter Scott, writer to the signet, and Anne (Rutherford), daughter of a professor of medicine at the University of Edinburgh. Through both parents, Scott was connected with many Border families. A fever in infancy lamed him for life. He was sent to his grandfather's, where he learned from his grandmother many old songs and legends; at the age of four, he was taken to Bath and London, in a vain attempt to find a cure for his infirmity. In 1778 he returned to Edinburgh, and was sent to the High School; at home he was encouraged to read Shakespeare, and was allowed to act occasionally after lessons. He read *OSSIAN* and *THE FAERIE QUEENE* at an early age, and before he was 10 had begun to collect ballads. In 1783 he pursued his favorite studies at college, reading Italian, Spanish and French. In 1786 he was apprenticed to his father as writer to the signet; he learned to be methodical, but he hated the drudgery of the work. Two years later he began his training as an advocate, and in 1792 was called to the Bar. Journeying frequently into the country, he heard many old tales, which fascinated him, and he collected more ballads, at the same time meeting many people who served as models for the characters in his later novels. When the French Revolution broke out, he was repelled, being a Tory, but his patriotism was stimulated. In 1797 he visited the English Lakes, where he met and fell in love with Charlotte Mary Carpenter, or Charpentier, the daughter of a French refugee; he married her at Carlisle, Dec. 24, 1797. His interest in German romantic literature had been aroused some time earlier, and his first literary venture was a translation of Bürger's *Leonore*, published in 1796; 3 years later he translated *Goetz von Berlichingen*. In 1799 Scott was made sheriff-depute of Selkirkshire, and in 1806 became one

of the clerks of session. His *Minstrelsy of the Scottish Border*, 1802, was welcomed by the critics, and in 1805 was published *The Lay of the Last Minstrel*, a brilliant success which determined Scott's career, though he never gave up the law. His connection with James Ballantyne began in 1802, when the latter set up his press in Edinburgh; in 1809 he became a secret partner in the publishing firm of Ballantyne, which was started to rival Constable, who later bought Scott's copyrights. Scott began an edition of John Dryden's works in 1802; it was published, in 18 volumes, with a life, in 1808. In 1802, also, he began *Waverley*, but dropped it when his friend Erskine disapproved of it. *Marmion*, 1808, was received with the success which had greeted the *Lay*, though it was attacked by Jeffrey of the *Edinburgh Review*, to which periodical Scott was a contributor. When the *Quarterly Review* was established in 1809, Scott contributed to it. *The Lady of the Lake* appeared in 1810; this third "novel in verse" was as successful as the other two, having



ABBOTSFORD, ON THE TWEED, HOME OF SIR WALTER SCOTT

the romantic spirit later embodied in his prose novels. An edition of Jonathan Swift, which had been some time in preparation, appeared in 19 volumes, with a life, in 1814. In 1812 Scott bought ABBOTSFORD, his home for the rest of his life. He published *Rokeby* in 1812, *The Bridal of Triermain*, 1813, *The Lord of the Isles* and *The Field of Waterloo* in 1815, and his last long poem, *Harold the Dauntless*, in 1817. These were not as successful as the earlier poems had been, and Scott felt that he had been eclipsed by the popularity of Byron. In 1814, Ballantyne's affairs became seriously involved, and as Scott also needed money for his estate, which he had been enlarging, he finished *Waverley* which was published anonymously, the first of a long line of successful novels. *Guy Mannering*, 1815, *The Antiquary*, 1816; the various series of "Tales of my Landlord," including *The Black Dwarf* and *Old Mortality* in 1816; *Rob Roy* and *The Heart of Midlothian*, 1818, *The Bride of Lammermoor* and *The Legend of Montrose*, 1819; one novel followed fast upon another. A severe illness in 1817-20 did not stop Scott's pen, and the highest point of his literary

career was marked by the appearance of *IVANHOE* in 1820, the year he was made a baronet by George IV. *The Monastery and The Abbot*, 1820, followed close; *Kenilworth*, 1821, *The Pirate*, 1822, *The Fortunes of Nigel*, 1822, *Peveril of the Peak*, *Quentin Durward*, *St. Ronan's Well*, all in 1823; *Redgauntlet*, 1824; *Tales of the Crusaders*, including *The Betrothed* and *The Talisman*, were published in 1825; *Woodstock* in 1826. This year Constable failed, and Scott was involved for £120,000. Scott set to work with courage and vigor to pay off his indebtedness; his *Life of Napoleon*, in 9 volumes, appeared in 1827, the year he announced the authorship of the *WAVERLEY NOVELS*, an authorship which had long been suspected. *The Chronicles of the Canongate*, 1827, *The Tales of a Grandfather*, 1827-30, *The Fair Maid of Perth*, 1828, *Anne of Geierstein*, 1829, all these told upon his strength, and in 1830 signs of a breakdown were apparent. He adopted a strict régime, however, and kept on. *Count Robert of Paris* and *Castle Dangerous* appeared in 1831, and then it became evident that, if Scott were to live, he would have to seek a warmer climate. In Oct. 1831 he went on a British frigate to Malta; then to Naples, Rome, the Tyrol, down the Rhine, and when another attack came, he was carried to Abbotsford to die, his death occurring Sept. 21, 1832. Four children survived him.

Loved by great and small, honorable, hospitable, generous, a patriot not only in his affection for his country, but for its past which he vitalized in his novels and poems, a tireless worker whose productivity has rarely been equalled, Scott gave pleasure to thousands of his contemporaries, and will be read with satisfaction, as long as the romantic has an appeal. *See also* ENGLISH LITERATURE; ROMANTICISM. R. W.

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SCOTT, WALTER DILL (1869-), American educator, was born in Cooksville, Ill., May 1, 1869. He graduated from Northwestern University in 1895 and took his Ph.D. at the University of Leipzig in 1900. The following year he returned to Northwestern University where he was associate professor of psychology and education until 1908; professor of psychology from 1908-20; and in 1920 became president. In addition Scott served in 1917-18 as director of the committee on classification of personnel in the army, and from 1919-21 as president of The Scott Co., consultants and engineers in industrial personnel. Scott is the author of *Theory of Advertising*, 1903; *Psychology of Public Speaking*, 1907, and *Personnel Management*, 1923, and joint author of *Man and His Universe*, 1929.

SCOTT, WINFIELD (1786-1866), American soldier, was born at Petersburg, Va., June 13, 1786. He studied law at William and Mary, but entered the army in 1808 with a captain's commission. On the outbreak of the War of 1812, he took his regiment to the Canadian frontier, where he led the attack on

Ft. George, May 27, 1813. In 1814 he was made brigadier-general, and the same year distinguished himself at the Battle of Chippewa. He was appointed commander of the department of the East in 1829. In 1847 he was sent to Mexico, and was the chief figure in the brilliant maneuvers which ended with the surrender of Mexico City on Sept. 14. As Whig nominee for the presidency, he was defeated in 1852 by Franklin Pierce. He was commander of the Union armies at the outbreak of the Civil War, giving over command to McClellan, Nov. 1, 1861. He died at West Point, N.Y., May 29, 1866.

SCOTTDALÉ, a borough in Westmoreland Co., southwestern Pennsylvania, situated in a coal-mining and agricultural region, 49 mi. southeast of Pittsburgh. It is served by two railroads. Scottdale has many industries, including coke making, the manufacture of cast iron pipe, the milling of sheet and tin plate, and blast furnace and railroad shop work. Pop. 1920, 5,768; 1930, 6,714.

SCOTTI, ANTONIO (1866-), Italian operatic baritone, was born at Naples, Jan. 25, 1866. At Naples he studied with Trifani Paganini and in 1889 made his début at Malta as Amonasro in *Aida*. He sang in opera for seven seasons in South America, and also at Madrid, Warsaw, and Odessa. His London début occurred in 1899, in which year he joined the Metropolitan Opera, New York. His best rôles are as Scarpia, Tonio and Falstaff.

SCOTTSBLUFF, a city in western Nebraska, the county seat of Scotts Bluff Co., situated on the North Platte River, 20 mi. from the state's western border. Bus and truck lines and two railroads afford transportation. Sugar beets are the chief crop of the region, and beet-sugar is the city's principal manufacture. An experiment station of the United States Department of Agriculture is located nearby, and also Scotts Bluff National Monument, covering 1,894 acres, through which passes the old Oregon Trail. Scottsbluff was founded in 1900; chartered in 1911. Pop. 1920, 6,912; 1930, 8,465.

SCOTTS BLUFF, a national monument created Dec. 12, 1919, is situated in Scotts Bluff Co., western Nebraska. The monument has a total area of 1,893.83 acres. The Bluff is an enormous mesa which was an important landmark and camping place during the days of travel on the Old Oregon Trail in the opening up of the west. Thousands of settlers on their way to Washington, Oregon, California and Utah passed by the Bluff. It is estimated that during the summer months at the height of the westward movement an average of one wagon every five minutes went through Mitchell Pass, the scene of many Indian battles, now included in the territory of the monument. A foot trail leads 480 ft. to the top of the bluff which commands a magnificent panoramic view of the North Platte Valley. Fossil remains of the three-toed horse, the Miocene camel, mammoth turtles and other prehistoric mammals have been found in the region just north of the Bluff.

The monument is reached from the city of Gering

on a branch of the Union Pacific system and from Scotts Bluff on the Chicago, Burlington and Quincy railroad. Good automobile roads traverse the North Platte Valley and motorists may still follow the Old Oregon Trail through Mitchell Pass.

SCOURGE OF GOD (from Latin *Flagellum Dei*), the name given to Attila, King of the Huns (reigned 434-453) because of the dread which he inspired. Attila's devastating invasions of Europe reached their climax at the Battle of Chalons, 451, when the Hunnish forces were turned back by Thorismunde and the Goths. Attila appears in Teutonic legend as Etzel and in Scandinavian saga as Atli.

SCOURING, in textile manufacturing, the cleansing of all fibers of goods wherein the natural, added, or accumulated dirt, oil, size, and other unwanted materials are removed. In its original state, natural or raw cotton contains waxes, pectic and protein materials. Wool from the sheep contains wax (wool grease), suint or dried perspiration, and dirt. Raw silk contains sericin (silk gum) and some fatty matter. These unwanted materials are removed by scouring before or after the manufacture of the goods. The most common scouring bath consists of water and soap, often assisted by an alkali. Some wool is "solvent-scoured" with petroleum naphtha or other solvents in a closed extraction system. Wearing apparel, furs, and blankets are "dry-cleaned" in a similar manner. The temperature of scouring varies widely for the different fibers and the results desired. Undyed cotton is often scoured with sodium hydroxide (lye) solution at the boiling point or under 10 to 20 lbs. steam pressure, by a process called "kier-boiling." Wool is generally scoured with soap solution, with or without sodium carbonate, at not over 120 to 140° F., and synthetic yarn materials at a higher temperature. Silk is scoured in a boiling solution of olive oil soap, or with so-called boil-off oils.

C. E. M.

SCOUTING, operations by a military or naval force to obtain information of the enemy or of the country. Army scouts are individual soldiers working alone, in pairs or in larger groups, each having individual missions and each responsible for carrying out his mission. If the group is placed under the command of a leader who is made responsible for the accomplishment of the mission, then it is called a patrol. Scouts should be trained in the use of the compass, field glasses and cover, in map reading and characteristic trail signs, in habits of observation, examination of prisoners, in estimating the size of enemy forces and forming conclusions from their strength, composition and movement. G. V. H.

There are five distinct types of Navy scouting operations: 1. Scouting to find the enemy, called search. This operation is aggressive. It is based upon information received from spies, secret agents or from observation forces which are of insufficient strength to track the enemy. 2. Scouting, when in contact with the enemy, called contact scouting. Contact scouting is of two types, strategical scouting and tactical scout-

ing. Strategical scouting includes operations after a contact with the enemy's main force or its screen, before one's own main force or other force detailed to attack is within striking distance, to determine the general direction of movement, composition and disposition of the enemy's main force and its screen. Tactical scouting includes operations when the main force or other force detailed to attack is within striking distance, to obtain constant information of the location of the enemy's main force and its strength and disposition. 3. Protective scouting comprises scouting operations confined to insuring the absence of the enemy from areas from which the main force may be threatened; and to obtaining just sufficient warning of the enemy's proximity to facilitate evasion or to assure adequate time for taking up battle formation. 4. Observation. This includes operations within a fixed area or on a fixed line, with a view to ascertaining the presence of the enemy within, or his absence from, that area, or his passage of this fixed line. 5. Reconnoitering, which means viewing for the purpose of obtaining military information.

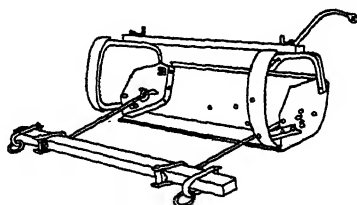
R. E. C.

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SCRANTON, the foremost anthracite coal mining city of northeastern Pennsylvania and the county seat of Lackawanna Co. It is situated on the Lackawanna River, 134 mi. northwest of New York City; five railroads, river craft and bus and truck lines serve the city. Scranton is extensively undermined, and one-fifth of the laboring population is engaged in the mining of coal. Other important occupations are the manufacture of lace, silk, textiles and wood and metal products, including automobile trucks, stoves, beds, springs and coal machinery. According to the census of 1930 factory output for 1929 was worth about \$60,000,000. The wholesale trade amounted to approximately \$108,474,060, and the retail trade amounted to \$80,267,135. Scranton is the seat of St. Thomas College for men, Maywood College for women, extension branches of the University of Pennsylvania and of Pennsylvania State College. The city is surrounded by attractive country, mountains and lakes. One of the largest glacial pot holes in the world is in the vicinity. The first electric car on which fares were collected was operated in Scranton in 1886, and the city was the first to develop and operate the third-rail system. Scranton was settled in 1788; the iron industry began in 1840; the city was chartered in 1866. Pop. 1920, 137,783; 1930, 143,433.

SCRAPER, in engraving, a tool for scraping from a metal plate the raised burr on incised line formed by the action of a ROCKER, ROULETTE, BURIN or DRY-POINT. After the ground has been prepared for a MEZZOTINT engraving by roughening the whole plate with a rocker, so that it will print solid black, the scraper, by smoothing off the roughness, brings out the high lights and the graduated tones of the picture.

SCRAPERS, in earth excavation work, are used on small jobs where extensive equipment is not justified. They are efficient in sand, gravel or clay which is not too hard and does not contain many large stones. The most common form is the "drag scraper," comprising a U-shaped steel bowl with two handles to aid loading and dumping. It is drawn by one or two horses, and is adapted to burrowing earth at the sides of embankments, "wasting" from cuts and ditches and open-



ROAD SCRAPER, FRESNO TYPE

ing mouths of larger cuts. It is not economical for hauls of more than 200 feet. The "Fresno" scraper differs from the drag in the form of the bowl and is carried on runners which carry the bowl in dumping and returning. It is easy to load, can distribute its load in layers, is very efficient in soft material, and for hauls up to 300 feet. The wheel-scraper is used for hauls of 200 to 800 feet.

W. J. D.

SCRAP METALS, metals which are useless in the form in which they exist but which, as metals, are unimpaired in value. Their commercial worth depends upon the ease with which they can be collected and converted into useful forms. In the iron and steel industry salvaged scrap comprises about half the production. Iron and steel scrap comes chiefly from railroads, structural and machine shops, often in the form of borings, turnings and trimmings. In the iron and steel industry much scrap is used directly with pig iron.

Useless castings, borings and cuttings of brass, bronze and other copper alloys are often remelted to obtain the copper. Precious metals, as gold, silver and platinum are recovered from jewellers' sweepings.

SCRAPPLE. Philadelphia scrapple or Ponhaus is made from the head and feet of pork, with sometimes a little beef and mutton added. The meat is boiled until it falls from the bones, chopped, mixed with the broth, thickened by cooking with cornmeal and buckwheat flour to the consistency of thick porridge, cooled, sliced and fried.

BIBLIOGRAPHY.—W. H. Tomhave, *Meats and Meat Products*, 1925.

SCREAMERS, a small family (*Palamedeidae*) of South American wading birds allied to the ducks and geese, and possessing remarkably loud voices. They have small heads, short fowl-like bills, large wings each provided with two sharp spurs, and very stout legs and feet which are not webbed. The crested screamer or chajá (*Chauna cristata*), a bird about the size of a turkey, dark gray above and white below with a black ring around the neck, is common in

swamps and lagoons from southern Brazil to Argentina. It feeds mostly upon water plants, clover and seeds, builds a high nest of dry rushes with its foundations in the water, and lays four to six buffish-white eggs. The powerful cry of this bird may, it is said, be heard for a distance of 2 mi. The somewhat larger horned screamer (*Palamedea cornuta*), with black and white plumage and a slender forward-curving horn 6 in. long, on its forehead, ranges from Guiana and Venezuela to Amazonia and Ecuador.

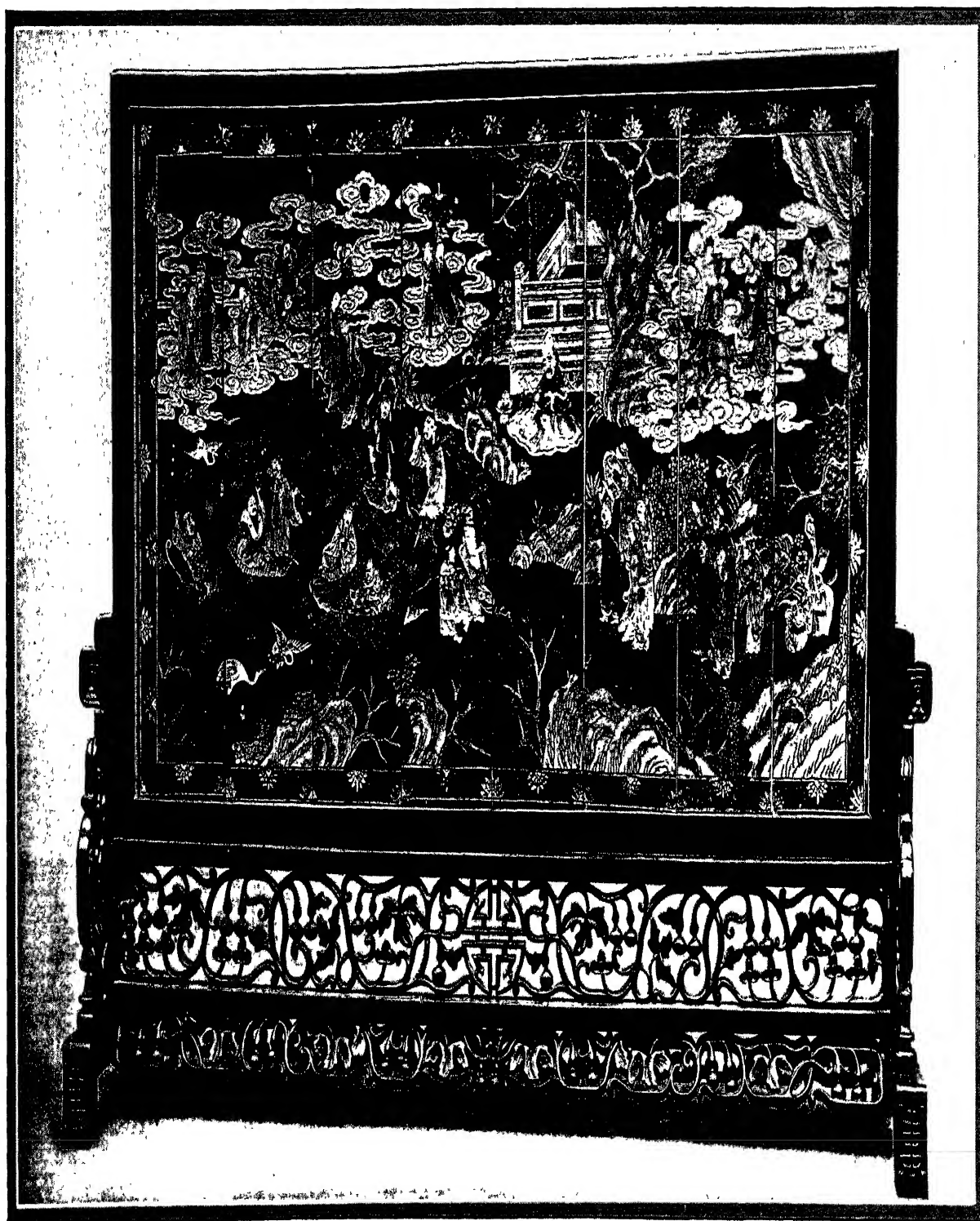
SCREEN, in mining. See ORE TREATMENT.

SCREEN, an article of furniture with an ornamental frame, usually made of metal or wood, for protection from observation, draughts or the heat of a fire. Tall folding screens were known in China as early as the 2nd century B.C. and their decoration has long been a highly developed art in both China and Japan. The early Chinese examples were composed of transparent mica or glass panels; before the Christian era they became more ornate, with carving and inlays of jade and precious metals. Chinese screen painting is of very ancient origin and was used in education, moral precepts being inscribed in fine calligraphy on the screen panels. Somewhat later tapestry, embroidery, crystal and lacquer came into use. The finest examples are the Coromandel screens, named after the coast from which they were shipped to Europe. These had wooden panels, finished with a coat of lacquer in which designs were incised and then filled with thick, opaque water colors. The technique dates from the Ming dynasty, but most of the existing specimens are of the 17th and 19th centuries. They included screens of gold and red lacquer, also of carved teakwood set with porcelain and jade plaques or paneled with embroidered silks and tapestries. Hinges were first used on screens in Korea in the 14th century. Most of the Oriental screens are of the six-fold variety, usually executed in pairs.



POLE SCREEN, HEPPLEWHITE STYLE

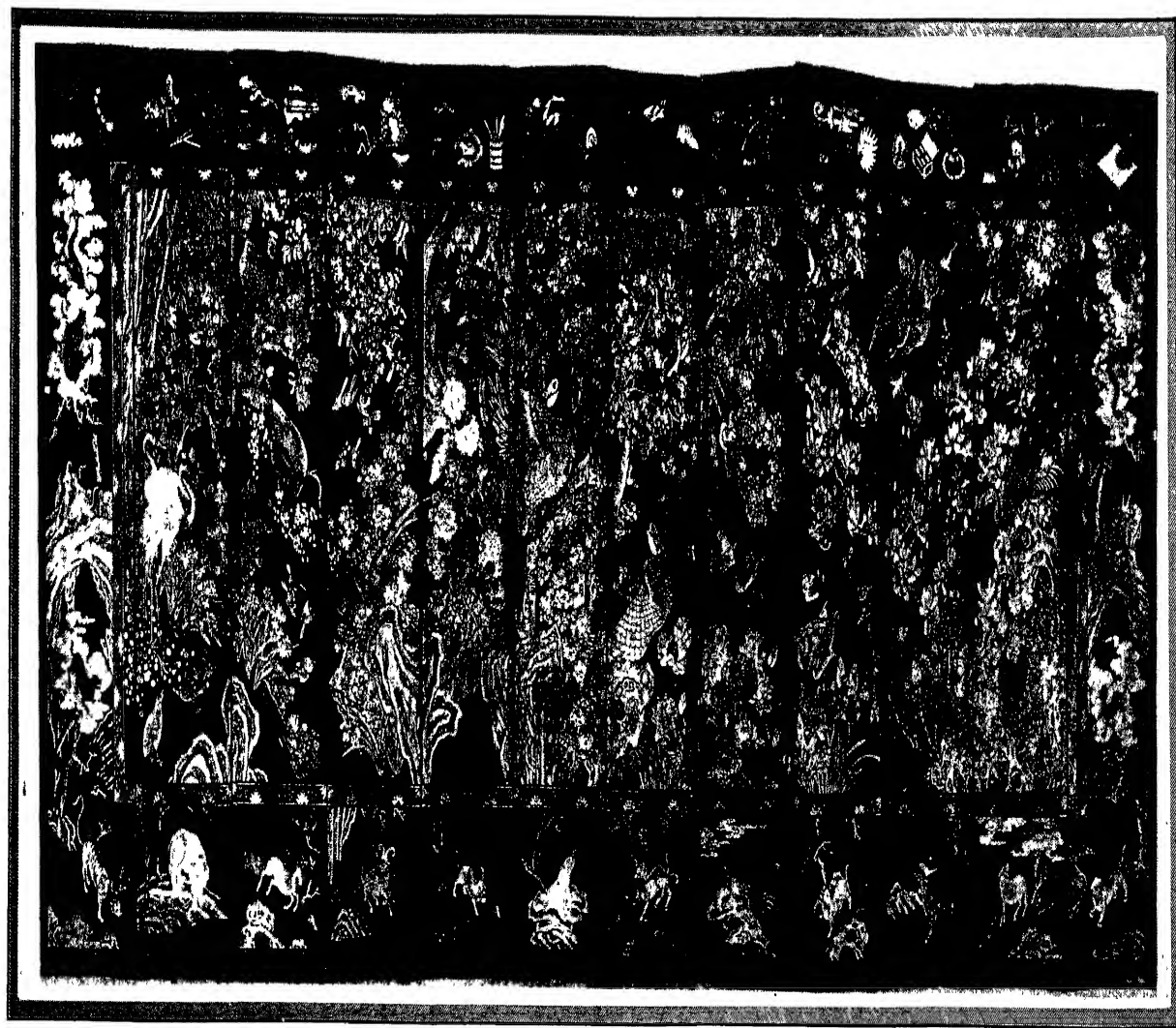
In Europe the large screen with several leaves was probably first used in the late 16th century. Stamped Spanish leather and tapestries were the favored materials, and lacquer enjoyed a great vogue in England in the 18th century. The small fire screen was of European origin; it reached its finest style in England with the development of Hepplewhite's pole screen. This was a small



COURTESY METROPOLITAN MUSEUM OF ART

A CHINESE LACQUERED SCREEN

A splendid example of Chinese lacquer work of the 19th century. An eight-fold screen of lacquered wooden panels decorated by a design cut through the lacquer and filled with various colors.



COURTESY C. T. LOO, ESQ., NEW YORK CITY

CHINESE LACQUER SCREEN OF THE K'ANG-HSI PERIOD (SEVENTEENTH CENTURY)

A twelve-fold Coromandel screen with polychrome decoration. Two popular motives are used, the Hundred Birds and the Flowers of the Twelve Months.

oval, oblong or heart-shaped frame, covered with needlework or silk, which slid upon a pole supported by a tripod. It was also extensively used in America.

Screens play an important rôle in modern decoration, as they are both ornamental and useful. Rooms decorated in the French manner lend themselves especially well to the use of tall, folding screens. Screen painting is by no means a dead art. Modern artists noted for their screens are Robert Chanler, Gardiner Hale and Joseph Platt.

(For the screen in architecture *see* ROOP and JUBE.)

SCREEN-GRID TUBE, an electronic tube (*see* TUBES, ELECTRONIC), sometimes called a tetrode, whose unique feature is a second GRID placed between the signal grid and the PLATE to reduce the electrical CAPACITY of these elements. Reduction of this capacity decreases the tendency of the tube to maintain oscillations (*see* OSCILLATORY CIRCUIT) when tuned grid and plate circuits are associated with it. Not only is the necessity for neutralization avoided, but the tube may be built to have a much greater AMPLIFICATION factor, without becoming unstable, than can a corresponding three-element tube.

SCREW, a cylindrical or conical piece of material, usually metal, having a helical groove cut around it, the ridge between successive turns of the groove being termed a *thread*. The conical screw is used with wood in place of the nail where superior holding qualities are desired. The cylindrical type is provided with a nut, or mate screw, comprising a corresponding helical groove, or female thread, cut inside a hole in a piece of metal. The two may be used for holding or clamping two objects together or for transmitting FORCE where it is desired to gain a "mechanical advantage" at the sacrifice of speed. The ordinary bolt is an example of the former use and the JACK SCREW of the latter. Since the thread is, in reality, an INCLINED PLANE its mechanical advantage is large and its holding power is great. *See also* SCREW THREADS; SCREW PRESSES; DIES; TAPS AND DIES.

SCREW BEAN. *See* MESQUITE.

SCREW DRIVER, a hand tool for forcing screws into wood or metal. It has a flat blade that fits the slot in the screw head and a handle to provide a grip. Screw drivers are made in many sizes from that of the miniature one which the jeweler twirls between his fingers, to heavy tools with a square shank on which a WRENCH can be used. Some are made with a ratchet handle to allow the hand to turn back for another grip, these being especially useful in cramped quarters. Screw drivers are also made for use in a "brace," and power-driven types are often used in industry. These last usually have a friction clutch that slips when the screw is set to a predetermined tightness.

F. H. C.

SCREW PINE, a large genus (*Pandanus*) of flowering plants of the screw pine family. There are about 250 species, all shrubs or trees, native to the tropics of the Old World; a few species are cultivated for ornament or for their fiber-bearing leaves.

They are plants of striking, somewhat palmlike appearance with pineapple-like leaves arranged in spiral masses, whence the name screw pine. The flowers are borne in dense heads or oblong spikes; the fruit is a large ball-like mass of crowded carpels each containing a several-seeded nut. The Madagascar screw pine (*P. utilis*), which grows 60 ft. high, is cultivated for ornament. The leaves of many species are used in making baskets and various other articles.

SCREW PRESS, a machine which applies pressure by a screw operated either by hand or power. Although not as rapid as the Crank Press, it has advantages for certain classes of work. *See* PRESSES AND PRESSWORK; *also* HYDRAULIC PRESS.

SCREW SHELL, the popular name for members of a family (*Turritellidae*) of sea snails. There are some 190 species, found in all parts of the world. As their name suggests their shells are elongate, spirally coiled, like screws, with one turn revolving above another, and pointed at one end. They may be brown, white or pinkish in color. The snails have fringed mantles and long tentacles, at the base of which are the eyes. *See also* SNAIL.

SCREW THREADS, regularly spaced helical grooves around a BOLT or bar, designed to connect with mating pieces, such as a *nut*, which have corresponding internal grooves. Screw threads vary from coarse threads of one turn in several inches to those of 254 threads per inch on small watch screws, 120 threads per inch being commonly used in such work. The distance from one point on a thread to a corresponding point on an adjoining thread is called the "pitch." On threads finer than one per inch, this is given in the number of threads per inch; for coarser pitches it is given in inches. The distance a screw or nut travels in one revolution is called the "lead." Lead and pitch are the same when there is only one helix around the piece, called a *single* thread. In many cases a rapid longitudinal movement is desired and two, three or four threads are cut, each being only one-half, one-third or one-fourth the depth and width of the normal thread for that lead. This gives the advantage of a rapid or fast thread without weakening the screw with a deep thread. A single turn of the screw gives a movement equal to the lead of the helix and as many times the *pitch*, or distance between adjoining threads, as there are separate threads cut on the piece.

There are also many forms of threads. The American National or Standard thread in this country has a 60° included angle and the top and bottom of the thread is flattened by 1/8 of the thread depth. This was originally called the Sellers thread and later the U.S. thread but is now known as the American. The same form of thread is used in the International or Metric Standard but pitches are different. Great Britain uses two forms of thread, the Whitworth with 55° included angle and the British Association with an included angle of 47½°. Both of these are round at the top and bottom.

The square form of thread, with modifications that

make the sides at varying angles with the axis, is also largely used. A common variation is the Acme thread in which the included angle of the sides is 29° with a wide flat top and bottom. A similar thread, having the same angle but cut considerably deeper, is the worm thread used in connection with worm gears. See GEARS AND GEARING. Another modification is the *butress* in which one side is 90° , or square



STANDARD SCREW THREADS

1, American National; 2, International or Metric Standard; 3, Whitworth Standard; 4, British Association Standard; 5, Square; 6, Acme 29° ; 7, Butress; 8, Dardalet

with the axis, and the other side 45° . This thread is only used where the pressure is always against the square or 90° side. A newer form of thread which has not come into general use is known as the *Dardalet*. It is similar to the American standard thread but the bottom of the thread is not parallel with the axis but at an angle with it. The nut does not fit on the sides of the thread as with all others but is supposed to ride up on the incline and so lock the thread against loosening. See also LOCK NUT. The various threads are shown herewith.

F. H. C.

SCRIABIN, ALEXANDER NICHOLAEVICH (1872-1915), Russian music composer, was born at Moscow, Jan. 10, 1872. A pupil of Safonov and Tanciev at the Moscow Conservatory, he taught there from 1898 to 1903, thereafter devoting himself to composition. Although his output was not great, his chief works comprising ten pianoforte sonatas, four orchestral tone-poems, and two symphonies, he left an enduring mark on the musical literature of his country. A radical harmonist and an impressionist, he gave a modernist complexion to Russian music. Theosophical interests, coupled with the growth of a generally mystical attitude, betrayed his musical genius by drawing it into experiments with the fanciful relationship between color and tone, as witness his *Prometheus* tone-poem which called for the simultaneous projection of colors. However, his metaphysical fancies left the bulk of his music undamaged, and several of his sonatas as well as two symphonies, *The Divine Poem* and *The Poem of Ecstasy*, remain testaments of a remarkable tonal genius. He died at Moscow, April 14, 1915.

SCRIBE, AUGUSTIN EUGÈNE (1791-1861), French dramatist, was born at Paris, Dec. 24, 1791. He was educated for the law but began writing plays before he was 20, and from his first success in 1815

devoted himself wholly to that work. To his law training, however, he may have owed the systematic and untiring industry, and the methodical collaboration, which made his prodigious output possible. Either alone or in collaboration Scribe produced between 350 and 400 plays, and there was no type of theatrical composition at which he did not try his hand. His fame rests especially upon his sound and original technique, which served as model for later dramatists, and also upon his reflection of the life and ideas of the "average man." His plays include *Valérie*, 1822, *Une Chaîne*, 1842. He also wrote the libretti for *Les Huguenots*, 1836, *Manon Lescaut*, 1856, *Le Prophète*, 1849, and *Fra Diavolo*, 1856. He died at Paris, Feb. 20, 1861.

SCRIBES (Hebrew, *soferim*), the ancient Jewish expounders, teachers and interpreters of the Hebrew Bible, who first developed their teachings and regulations in the form of the Oral Law, especially in the period beginning with Ezra, about 444 B.C., and continuing for several centuries. The exact date of the cessation of their activities is unknown, although it has been placed in the time of HILLEL (c. 20 A.D.), or slightly later.

Beginning with the time of EZRA the Scribe, the term scribes was applied to the teachers who cultivated the Torah, or Pentateuch, and then the entire Bible and its teachings. Their work later became the Oral Law; it consisted of restrictions which the scribes had set about the Written Law (Torah) for the purpose of safeguarding it, and of amplifications and explanations of its text, which were made in order to take into account conditions not as yet in existence when it was first written. The term scribe as an official title is first applied to Ezra, who is generally deemed to have been the founder of the school of the Scribes. (Ezra 7:6, 11-12, 21.) At first the word scribe meant merely one who copied sacred scriptures, laboriously writing out one parchment copy of the sacred text from another. Later it acquired a deeper and more spiritual significance, so that the activity of the scribes as mere copiers of the manuscripts of the Law ceased, and the word scribes itself gradually lost this significance as applied to them. Thus the scribes, in the course of time, gradually replaced the prophets and the priests, and later, too, the Sadducees as well, and became the actual religious leaders of the Jewish people.

The scribes confined their activities not to the interpretation of Scripture, but to elaborating and amplifying it on the basis of tradition and of their religious sentiments and convictions. However, they are generally credited with having collected the writings of the prophets and the Hagiographa, and with having given the first expression, in the form of the Oral Law, to hundreds of traditions and new customs which had developed in the course of the preceding and current periods.

A. SH.

SCRIBNER, CHARLES (1821-71), American publisher, was born in New York City, Feb. 21, 1821. He was educated at the University of New

York and at Princeton College, graduating in 1840. After traveling in Europe for his health he formed a partnership with Isaac D. Baker in the bookselling and publishing business in New York, 1846. Sometime after the death of Mr. Baker, Charles Welford became a partner, 1857, and the firm made a specialty of the importation of books from England, and in the publication of educational books. In 1865 *Hours at Home*, later *Scribner's Monthly*, was established. When it was sold in 1881 it was rechristened *Century Magazine*. Scribner died in Lucerne, Switzerland, Aug. 26, 1871. His firm became Charles Scribner's Sons in 1879, and the new *Scribner's Magazine* was established in 1887.

SCRIPPS COLLEGE, a college for women located in Claremont, Cal., 36 mi. east of Los Angeles, was founded in 1927 with funds provided by Miss Ellen B. Scripps of La Jolla, Cal. POMONA COLLEGE and Scripps are the first two units of a series of colleges which will be located in Claremont under the group name of Claremont Colleges, a central organization incorporated Oct. 14, 1925. Each college will have certain specialized courses and facilities not duplicated in other units. Courses in Scripps are offered in five major fields, literature, arts, history and economics, sociology and philosophy, and science. The total enrollment in 1931 was approximately 200, and is not to exceed 250. The faculty of 36 was headed by Pres. Ernest J. Jaqua.

SCROFULA: Tuberculosis of the lymph nodes. See ADENITIS; LYMPHATIC SYSTEM, DISEASES OF.

SCRUTIN D'ARRONDISSEMENT, a French system of voting for members of the Chamber of Deputies, in which the *arrondissement* or subdivision of the department is the electoral district. It has resulted in usually giving an *arrondissement* a single member to be chosen.

SCRUTIN DE LISTE, an electoral plan under which the FRENCH DEPARTMENTS, 89 in number, are the electoral districts, each choosing a number of deputies proportioned to population. The voter thus elects several representatives to the national legislature at once. The names of party candidates form a list, and by the law of 1919 proportional representation in a simple form was introduced. By the law of July, 1927, France returned to single member districts (*uni-nominal* system), in which an *arrondissement* or portion of an *arrondissement* forms the electoral district and constituency.

SCUDDER, HORACE ELISHA (1838-1902), American author and editor, was born in Boston, Mass., Oct. 16, 1838. Completing a course at Williams College in 1858 he taught school in New York City until 1861, when he took up literary work in Boston. From 1867-70 he edited *Riverside Magazine for Young People*, and from 1890-98, the *Atlantic Monthly*. Although widely known for his critical works and his juvenile books, which include *Seven Little People and Their Friends* and the *Bodley* books, Scudder's biographies, notably his *Life of James Russell Lowell*, have achieved a greater importance.

He also wrote *Life and Letters of David Coit Scudder*, *Noah Webster, History of the United States* and *Childhood in Literature and Art*. Scudder died at Cambridge, Mass., Jan. 11, 1902.

SCUDÉRY, MADELEINE DE (1607-1701), French writer, was born at Le Havre, Nov. 15, 1607. Plain and poor, she settled in Paris with her brother, GEORGES SCUDÉRY, and was admitted to the brilliant circle of Madame de Rambouillet. Soon she formed a modest salon of her own and became recognized as the foremost bluestocking in Europe. She was the author of immensely long novels, *Le Grand Cyrus* and *Clélie*, both in 10 volumes. In them she painted her contemporaries, thinly veiling their identities under classical or Oriental names. Madeleine de Scudéry died in Paris, June 2, 1701.

SCULPIN, the name of a large group of spiny-rayed marine fishes of one family (*Cottidae*), including the miller's thumb, many of which are oddly shaped and brightly colored. They are usually found along rocky coasts in northern waters, though some live in deep water. The sculpins are characterized by large, flattened heads, decorated with irregular spines and depressions, wide mouths, and long fins, especially the pectorals. Their bodies, tending to taper back from the head, are covered with smooth skin, sometimes protected along the sides by bony plates. They feed on water animals and are preyed upon by other fishes. One of the most frequently seen sculpins (*Myoxocephalus groenlandicus*) reaches a length of 2 ft. A majority of these fishes are colored with mixtures of brown, black and yellow.

SCULPTOR (gen. *Sculptoris*), a constellation containing only faint stars, immediately following Fomalhaut and Piscis Austrinas. See STAR: map.

SCULPTURE, the art of working in solid materials and in three dimensions to represent real or imaginary forms. The sculptor is interested in giving to the layman the viewpoint of the artist and not the viewpoint of the historian, biographer or archaeologist. He is interested in the intrinsic and significant qualities of sculpture. To the artist, art is a language revealing the pageant of humanity through the ages. The desire of man to recreate himself in a more perfect image either physically, spiritually or mystically, has existed in all races at all times. The art of a people is not only an expression of the physical likeness of that people, it is the molding into permanent form of the innermost character and soul of that people, of their emotions, their appreciation of form and their traditions. Some are mystically religious, some pagan, some primitive, some highly cultured, others decadently ferocious. Art is a traditional use of form handed down and inherited throughout the ages. A person is either born an artist or not. There have been a great many so-called works of art through the ages that are mere work, but here and there we find an age or an individual work that has art content. The layman often asks how is he to recognize this quality in art. If men are not born with an innate sense of discrimination and sensitiveness

towards art, they can develop this sense through study and contact with art and artists.

Sculpture can have a beautiful surface and be an empty shell if it lacks art content which is the inner life, the power of creative expression through sculptural form. When we look at a bridge or building we see a definite form but we know that an engineer and an architect have had a thousand and one problems to solve in order to evolve that form, problems of organization, symmetry, balance, weight and space. No matter how simple the sculptured form, the sculptor has had the same problems to solve. He has been architect, engineer and laborer. These problems are so important in the creation of a work of art that the artist can never understand the layman's awe of surface finish and photographic representation, and it is difficult for a layman to understand that when a work of art lacks these qualities, it is because the artist is not interested in them but is seeking something more fundamental which they would only destroy. Technique is a means of expression and not an end. Too great an interest in technique shows a shallowness in the artist and in the art.

Before man could carve or model, he found ways and means of cutting the hardest stones, shaping arrowheads and spearheads. He found stones in which he visualized objects, grinding down the surface with other stones, water and sand. He found clay which he shaped and baked. He discovered methods of drilling to split and polish rocks. These were his first methods and instruments. These methods are very much the same to-day. The traditions of craftsmanship are as old as the human race. In the Metropolitan Museum there is a pointed chisel taken from an Egyptian tomb. This is the same character of tool as is used to-day; only it is of bronze where we use steel. Fine sculpture has been accomplished with the most simple and rudimentary tools. The most fundamental tools of a sculptor are a chisel and hammer. With these two tools and a block of wood or stone, if the man is an artist, he can produce a work of art. To-day there is an endless variety of tools, variations of the chisel, that an artist may use. There is even a pneumatic chisel run by electricity.

Modeling and Casting. Since the Renaissance the usual approach to sculpture has been through modeling. In modeling in clay, the sculptor uses his hands, the thumb making the most useful tool, building up the form with layer upon layer of moist clay upon a skeleton of wire and lead held by a steel support or armature. This method is still used by most sculptors to the exclusion of all others. Clay allows great possibilities of change and greater freedom for the expansion of forms and movement. It avoids the difficulties of direct carving, but it can too easily miss the fundamentals. The character of clay and the molding of form with the hands is the natural technique for work to be transferred into molten metal, but it is not without its weakness as a method of sculpture. Its ease of handling makes it a vehicle for the man of little talent.

There are many ways of modeling in clay. Each artist develops his own methods to some extent at least and also the tools suited to his needs. Some sculptors pile on huge masses of clay, cutting and pounding the mass into shape with blocks of wood as hammers and round pieces of wood to roll out surfaces, finally finishing the surface by modeling with the fingers. Another method is to apply small bits of clay, or bullets, slowly building up the form. The final surface has a stippled effect that is particularly effective when transferred to bronze, although it tends to a monotonous surface. Another method is to make a rough model in clay, cast it in plaster, work over the plaster with rasps and sandpapers, cast it in bronze and file and chase the bronze to a smooth surface, finally buffing the metal to a high polish. When the clay model is finished it is cast in plaster of paris. This is done either by a waste mold, which destroys the original and allows only one copy, or by a piece mold which requires much skill and allows the making of many copies while still retaining the original.

The plaster cast is simply a step towards a permanent form. The sculptor may have his work cast in bronze or pointed up in stone. There are two methods of casting in bronze, the sand mold and the lost wax process, both of which are complicated. Casting is not done by the artists to-day but is executed in large bronze foundries. There is no such thing as an original bronze. Any number of copies can be made from the plaster model. It is customary to cast three or six bronzes of a large piece, and from 10 to 20 of a small one, the price decreasing according to the number of copies. Bronze comes from the casting in a very rough state. If the artist himself works over a bronze, it is of greater value than when he leaves the finishing of it to workmen in the foundry. The natural color of bronze is a rich gold, but it is usually patined by applying acids and heat to give the desired color. However, some artists prefer to have the metal take on a natural patine with time.

If the sculptor wishes, he can have his plaster model pointed up in stone. This is a mechanical method and is usually left entirely to professional workmen, although some few artists do it themselves. The model is mechanically copied by a painstaking system of measurements done with a pointing machine, drilling the various depths of the model and chipping away the surface until the depth of each drilled hole is reached. Almost all monumental sculpture is done in this way, from small or full scale models, and left entirely to professional workmen without even the supervision of the sculptor. This tends towards an inferior piece of work. To obtain the finest results the artist should see the work through from beginning to end, supervising those employed to help him.

Carving. In direct carving there are a number of methods of approach. One is the method of cutting into a solid mass of stone, working one's way in, leaving the greatest mass at the back and gradually working in and around. This was obviously the method of MICHELANGELO. Usually small models or

sketches are made first and liberties taken with the form as the work progresses. Another is cutting the silhouette from all four sides and gradually rounding out the form. These same methods are used in cutting wood. Only a few carving tools are necessary, a mallet and a few round gauges and flat chisels, according to the size of the block. Rasps and files, glass and sandpaper can be used to give a smooth surface; otherwise the chisel marks are left. Great care must be taken in the selection of material, for many woods check and split. The Indians selected wood that had been under water for years. To-day woods are kiln dried; sometimes a hole is bored through the center to allow drying from within, the top and bottom are painted or the wood is used upside down. The best method is to keep various pieces of wood around the studio for years and use the ones which show the least tendency to check or crack.

The important thing is not whether the sculptor carves in wood, cuts direct in stone or models his forms in clay; the important thing is the art content of the work he produces.

Primitive Art. Most histories of art are based on the supposition that the art of an epoch reached its perfection when it became most accurate and photographic. They assume that certain periods of art in the past were undeveloped because their writers felt that these people had not yet reached the point of seeing realistic proportions. It did not occur to these historians of art that the development of these races might be in a different direction. Because primitive art did not fit in with our standards of realism, it was left to the ethnologist and the collector of curios. Fortunately the invention of photography has satisfied our thirst for representation and has made us realize that art is another and wholly different thing, that realism or lack of realism is merely incidental, that the laws of rhythm, design, balance and expression operate outside of such considerations and are the basis of art. If the ability to portray realistically and correctly is the proof of a highly developed and civilized race, the cave dwellers of Altamira, Spain, must have been more civilized than we, for they produced drawings of animals which we have yet to equal in perfection. A people may be primitive and produce a great art and a people may be highly civilized and produce an inferior art.

The idea of the art value of the abstract is not new. Socrates speaks of aesthetic reaction to abstract form. But it was the renewed consciousness of the abstract in art which Cezanne recognized, and Picasso, Braque and others after him, that awoke artists to a realization of the importance of primitive sculpture, and an especial interest in African carvings. These among primitive sculpture have reached the greatest power of emotionalized development and projection of form. The African sculpture was a highly spiritual art in that it was concerned wholly with the spirit of man. The African artist approached his work through awe or fear, a religious terror of natural phenomena. His masks were his effort to fortify himself in his belief

in supernatural power and throw the fear and terror into his enemy. In his fetishes there was at times a ferocious barbarity. He had a sense of form and proportional relation that was architectural in content; they were always held in balance and unity of design. These proportions were not in any way realistic but they had a sense of coordination, a sense of abstract form relation that is extraordinary. It is through the fitness of their form relation that they convey their power. Most primitive people have an innate love of design, usually developed to a high perfection. In the African this was particularly beautiful and abstract and however elaborate or fanciful, was always kept in its place and subordinate to the whole.

Egyptian Art. There have been a great number of rises and declines in art throughout the ages. The great periods of the development of sculptural art were reached in Egypt, China and Greece. These constituted a development away from the primitive to a civilized and cultural art. Egyptian art was concerned much more with the spirit of man than with his external form. It reflected a well-ordered life and an unwillingness to accept death. It was the work of a nation with a passion for permanence, with an appreciation for the soul and the intellect of man rather than his more personal emotions. Egyptian art has a dignity, a respect and contained calm beyond all other art and an expert craftsmanship that has never been excelled.

The Egyptians had a great appreciation of material and knew how to use its limitations to the greatest advantage. They developed certain conventions but still retained a great deal of individuality and personal expression, much more than we are apt to realize because their art and art forms are so far removed from us to-day that it has a tendency to look alike, just as all our art would look alike to them, were the table of time reversed. They were very direct in their approach, cutting direct into the hardest material but always with a definite plan in mind. They were great designers; their approach was definitely from a well thought out design, approaching the stone from all four sides. Their art has a tremendous power and strength; but a great deal of it has the fault of all extremely intellectual art, it is barren and cold in spite of the perfection of form. When Egyptian sculpture combined spirit with form, it could not be surpassed.

Art reflects not only the people but the country that people inhabit. Egyptian art was the perfect reflection of the creative fitness of its art to the character of the climate and the soil. It was part of the great spaces, the sharp clear planes where life was a miracle hemmed in by the barren deserts. It was to be seen out of doors, austere in the hard bright glare of the sun and cloaked in awe and mystery in the equally brilliant moonlight. The Egyptians have left us a more wonderful record of their lives and times than any other people of the past.

Chinese Art. The Chinese are a people whose roots are imbedded in traditional culture, whose re-

ligion has arrived at a philosophical acceptance of life, a reverence for the past and a confidence in the future. They live in a country of wooded mountains, clouds and mists, of fertile valleys, of well-ordered and beautiful gardens, of grottoes and shrines. Their art reflects such a world. It has great dignity and calm beauty, a simple direct workmanship and a highly individualized interpretation. There is something more loving and more human in the workmanship of Chinese sculptors than any other race has put into its art. The form is highly simplified and pure, often very elegant and graceful in movement. In the Chinese along with the spiritual calm, there is a sensuous quality, an appreciation of both flesh and spirit. But it is the mind that is significant to them, not the body; the spirituality of the mind conveys the expression of the face and the gesture and movement of arms and hands; very seldom does the body take on significance, and always it is subordinate to the head and hands. Draperies are highly simplified and designed on the basic form rather than modeled for any form in themselves. The heads and hands are especially beautifully modeled. The Chinese approach to sculpture was primarily direct and arrived at through the same mental process as their drawing and painting. Chinese drawing registers with a quick rhythmic movement the essential characteristic rhythm of an animal or figure arrived at through knowledge and observation of the form of an object rather than the study of models.

Most of the Chinese sculpture we see in our museums were figures cut direct in the native rock in the actual grottoes and shrines, and later removed by vandals and sold to Western dealers and collectors. The Chinese have such a tremendous art tradition which has so permeated the race that every little piece of handicraft if not rich in art quality, at least retains a flavor of it.

Beautiful sculpture was done in Assyria, and in India there was a great folk art such as our own Gothic in which huge edifices were built up through the infinite forms of sculptured figures and animals, a curiously sensuous art. And there was the lovely Kmer art of Cambodia which gives us some of our most beautiful heads and figures.

Greek Art. The Greeks were a pastoral people worshipping the perfect human body and creating mythological gods through an interpretation and idealization of the human form. In Greece nature was kind and beautiful, and life was pleasant, humanity flowered, life was young and lovable and pure. Woman was loved as Beauty, the Goddess; man was worshiped as even more beautiful than woman. Art was the essence of life, joyful and playful, simple and kindly, with a youthful fresh love for people and animals. The Greeks aimed to carry on into manhood the bloom of childhood. Their youths were fine human specimens, and they expressed their appreciation of them in beautiful pure form. Their horses were the spirited creatures of imagination. Greek art flourished in wonderful and

sympathetic surroundings. Existence meant the creation of beauty; and death, a peaceful departure. The Greeks may have had the ugliness inherent in all civilizations; but it found no expression in their art.

Greek sculpture, especially during the later periods, was concerned with the physical aspect of man. The Greeks' earlier efforts were simple and direct. The external form descended from the Egyptian; but the inner spirit had nothing in common with Egyptian sculpture. Archaic Greek art was unique in the development of mankind. In it were embodied all the fine qualities of the primitive, the direct simplicity, the decorative treatment and purity of form without fears, complexes and inhibitions, but with a simple pure loveliness. It was not mystically religious nor concerned with heaven and hell, but expressed a love for the life and forms around them.

The later Greeks became more and more concerned with developing a convention of the perfection of the human form until sculpture ceased to be a creation through observation and knowledge of the feeling of form but became an art of studying models, of measurements and calculations. This was the beginning of photographic realization, yet perfectly consistent. With the Greeks, we began to know form through the eye. Archaic Greek art was approached by cutting in and around the solid mass of stone from all four sides, and drapery followed the basic form. Later Greek art was approached by cutting into the stone from the point of view of depths, movements in and out and around the form. The Greeks did not retain the contour of the stone but penetrated the mass until they arrived at their preconceived model. In the end they even realistically copied the folds of the drapery of their models, not with consideration for the unity of the whole but with interest in the actual material, sometimes even destroying the form underneath. There was a sculpture of stonemasons, an expert craftsmanship developed through tradition. Although their form was based on realism, it was always interpreted through the medium of stone. The forms were expanded and liberated.

When the idea of representation as the criterion of art prevailed, people regarded Greek art as having reached its perfection during the age of Pericles. Greek art still had great charm and beauty even in the later periods, but the descent from Olympus had commenced. The most beautiful and finest Greek art is found in the Archaic period and up until after the building of the Parthenon. There the interest in the perfection of the human body and the physical beauty of man was still an adventure and not a formula.

The Romans copied this perfection and, as always happens, became interested in the minor surfaces and variations of form, forgetting the inner rhythm until we had men with beautiful muscles upon an empty shell without life or spirit. Unfortunately many know Greek art only through this medium of Roman copies. Roman art is usually thought of as one of the

most barren periods in history; yet during that time, they produced extraordinary portraits, heads that, although intensely realistic, have the great qualities of sculptural form. No finer portraits have ever been done.

The Renaissance. After the fall of Rome, and before the Renaissance, there were two periods of great art activity in Europe, the Romanesque colored by the East and Rome, and the Gothic, an art out of the north. Each was primarily an art of the people, a folk art related to architecture in which the workmen of the community took part. Sculpture was the stonemason's job. Each man had his place to make beautiful and he was not only the stonemason but the creative artist. It was the art of a people in the grip of religious emotion and carried beyond themselves by an idea. It was the art of a young race done from an instinctive knowledge and translated into a given space and material. It was not overstrained or intellectualized; there was often the element of play and fun. Forms were elongated and changed to fit the architectural scheme. A Gothic Cathedral designed by an architect to-day is a travesty of the art; all the life and variety which is its beauty vanishes when the carving becomes the carrying out of the design of a single architect. It is basically false and can result only in monotony. When a tremendous work is done collectively by groups of people, it can be done only by giving each liberty, by conceiving and executing each piece separately, and compiling the whole by slow stages until the cathedral emerges. The unity cannot come from a single man but from a mass mind in the grip of a great passion or a great idea.

Romanesque and Gothic art are extraordinarily beautiful in complication of design and form. Fundamentally it is nearest to the art of India in its folk production of a whole, made up of infinite individual pieces. A saint may be removed or a head broken off and mounted and it is still a beautiful piece of sculpture in itself, but fundamentally it is part of a mass and related to the whole architectural scheme.

The Renaissance was not an art inspired by religious enthusiasm but by a new medium and the sudden consciousness of the beauty of the antique. The invention of oil painting changed man's vision; he no longer felt the world about him as static form but visualized it as color and movement. Before the Renaissance, painting was almost like another form of sculpture and related to architecture. With the Renaissance it became an independent and individualized thing and sculpture began to take on the qualities of painting. Since the Gothic, there has been no great period of sculpture. There have been great sculptors and great works in sculpture but these have been isolated and not part of a movement. Yet the Renaissance was a great period for the artist. And his art was rich and exuberant. Religious subjects were an excuse for portraying well-organized groups of people wearing marvelous clothes and costly jewels. Sculpture became florid and full of movement. Flesh began to look alarmingly like meat. Sculptors reveled in

anatomy, the dissection of muscle. They became interested in what torture and suffering did to muscles and not in what suffering and torture did to man. Michelangelo was the outstanding sculptor of the Renaissance. The great quality of Michelangelo's sculpture was that, throughout the work, he was always master of his medium. He selected his material, created his ideas, cut his own stone and was always in communion with his idea and his material. Assistants were to him merely assistants, not workmen who carried out his work for him. His art was true sculpture in that it reveals the throb of the creator's soul and the warmth of the sculptor's hand.

As a whole, the sculptors of the Renaissance were expert craftsmen, but fundamentally most of them were jewelry designers on a large scale. Applied to architecture this was particularly objectionable. It is the antithesis of the Gothic where every sculptural form was subordinated to the architecture of the whole. Renaissance sculpture was always an individual conception without the slightest regard for the building it was supposed to embellish. There was a life and reason for this character of sculpture in its time; but it is the parent of all the bad taste in sculpture that has dominated Europe for the past 500 years, and its influence is seen in the host of imitations and elaborations which followed in Europe and America and which still dominate all academic sculpture up to the present day.

American Art. When we discuss periods in history such as the Greek and Egyptian, we must realize that at these periods of human development, art meant much more than it means to us to-day. It was a great wonder and achievement; it captured the imagination of whole peoples; it was the chronicle of their history and the expression of their beliefs and aspirations. At different periods, different ideas have fired the imagination of peoples. When art is a living thing in a human society, there is a great development of talents and abilities. Development of great talent in the past was always by an inherited and popular appreciation and an inherited pride in the work. What appreciation there is to-day is mostly in the making of collections or in speculation as to a future value. The great flow of creative energy of this age is absorbed in mechanical and scientific research. Sculpture is an art that is concerned primarily with the solid and eternal qualities, putting into permanent form our highest realization of life and deepest feelings. Our modern age of temporary structures, impatience and speed, is not conducive to producing a great American sculpture. It is only a very hardy individual who can place himself in opposition to the world about him and feel that no time and no effort are too great for the perfecting of his conception. Yet it is only with such an attitude that real sculpture can be produced. If great sculpture is developed in this age, it will come through individual sculptors and not in a popular movement.

America is always excused as being a young nation with no tradition. It is not that we have no inheritance; we have the inheritance of the whole world

to draw upon. We are not descended from any one nation but from all nations. America is also rich in her native background of primitive and ancient cultures. There is a distinct quality in the art of the Eskimo tribes and of the Indians which has all the direct power and decorative form basis characteristic of primitive tribes. And there are the Mayan and Aztec cultures paralleling early Assyrian and Egyptian art in a less developed form but with a distinct flavor and character of their own. As yet this native background of art has scarcely touched us. All our art inheritance comes, like ourselves, from Europe.

America is rich in another primitive art, the folk art of early America. In all ages and communities, individuals emerge from the main body of workers. Among the latter, there were, some 50 or 100 years ago, a number of marvelous woodcarvers of ships' figure heads and cigar store Indians, makers of weather vanes and occasionally carvers of exceedingly fine and interesting figures and animals, done without any utilitarian motive. A good deal of this was native folk art created by unsophisticated or primitive minded individuals, living within a civilized community. Although outside of the regular art status, some of these men were among the master carvers of American sculpture. There are a number of private collections of such work, the Drexel; Sewall; Eli Nadelman, the sculptor, and the Peabody Museum. Historical interest or the connection with boats and the sea, rather than art appreciation, inspire most of these collections; but people and museums are beginning to realize their real importance.

Our early American statesmen had busts done by Houdon, who was the finest sculptor of his time. This may or may not have been a sign of a cultivated and intelligent art sense in a certain class of people of that period. At least it is something that has never happened since. There has been absolutely no criterion of taste or even ability in official sculpture since the Revolution; no one was too bad for the jobs, and it was mere chance if a good man got a commission. Perhaps the Revolution cut us off from the flow of European sculpture. Perhaps it was merely the beginning of a period of false standards and bad sculpture. Certainly the situation in Europe was quite as hopeless as it was in America. From 1800 until the Civil War, American sculpture went through a period of provincial classicism, of amusing and often ridiculous imitations of the individual pieces of Greek sculpture and friezes. But these pieces were sincerely and conscientiously done, and although banal and void of sculptural quality, they were not as objectionable as the period of overornate and elaborate form that followed.

Meanwhile there was growing up a movement away from the classic towards a homely realism. American art became permeated with a passion for the realistic portrayal of the world about us. It was the rise of the school of American illustration and was reflected in every form of our art work including sculpture. Everything told a story, the wrinkles in the clothes,

the holes in the buttons, the details of shoe-laces, gave the sculptor as great joy as the perfect human body gave the Greeks. He could no longer see the whole, in his enthusiasm over every detail. He must be real in everything; but the real to him meant the wrinkles in the trousers, not the balance of mass against mass or the aspiration of the human soul. At its worst, it was a period of Roger groups and similar atrocities, and lasted from the Civil War until 1900. Some of it is still with us, we are still setting up doughboys and pioneer women. At its best, this period was a revolt against the sweet and prettified, and an appreciation of the genuine merit and sober qualities of everyday people expressed with an intense interest in the realistic study of surfaces. This form of art reached its highest expression in AUGUSTUS SAINT-GAUDENS.

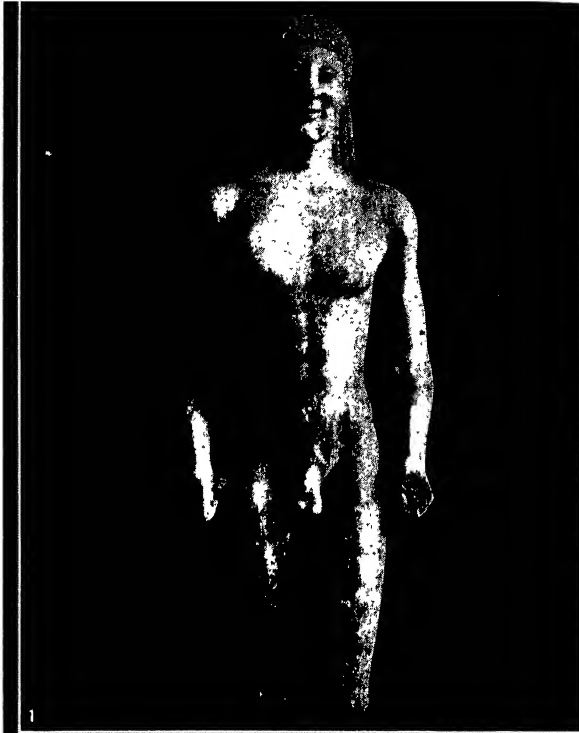
When the illustrative idea ceased to fire the imagination and became the commonplace, classicism began to creep back again into art, sometimes in combination with illustration, sometimes as in the work of GEORGE GREY BARNARD, with a more intelligent understanding in interpretation of the classic. A still different development was that of PAUL MANSHIP, which added an appreciation of the qualities of Oriental art, a regard for balance and form relation that did not exist in American art before, a development of the decorative and of the silhouette.

Just before the World War, there was born a new consciousness of art and art forms, this thing people call Modern Art, but which will some day be simply Art. There was a new and intense interest in the grand qualities of sculpture which had been forgotten. There was a tendency towards the elimination of the superficial, arriving at a robust and vital approach, a simplification that was almost primitive at times and purely abstract at others. Pure form was stressed, the correlation of form and volume, the interplay of rhythm and design. Such is the character of certain sculptors working in America to-day, such as Archipenko, Brown, Diederich, Faggi, Flannagan, Gross, Harkevey, Lachaise, Laurent, Nadelman, Noguchi, Nakian, Storrs, Schmucl, Sterne, Scaravaglione, Warneke, Wheelock, Zorach and others. Of their ultimate value in sculpture, future generations will be the judge. At least we know that they are the serious and creative workers of to-day.

In Europe there have been two distinct developments, the simplified and the abstract. In America the simplified prevails. American business with its enthusiasm for novelty and change, has completely adopted the abstract for commercial purposes, until the genuine among the young sculptors have felt that perhaps after all it really belonged in the realm of pure decoration.

While isolated sculptors are working out a fundamental and personal art, our foundries are busy turning out the same old official atrocities, colossal equestrian statues, Liberties, Lincolns, the inevitable doughboy and war memorials, cupids and frogs, to clutter up the public squares and gardens of America, and crystallize the undeveloped art taste of the nation.

SCULPTURE

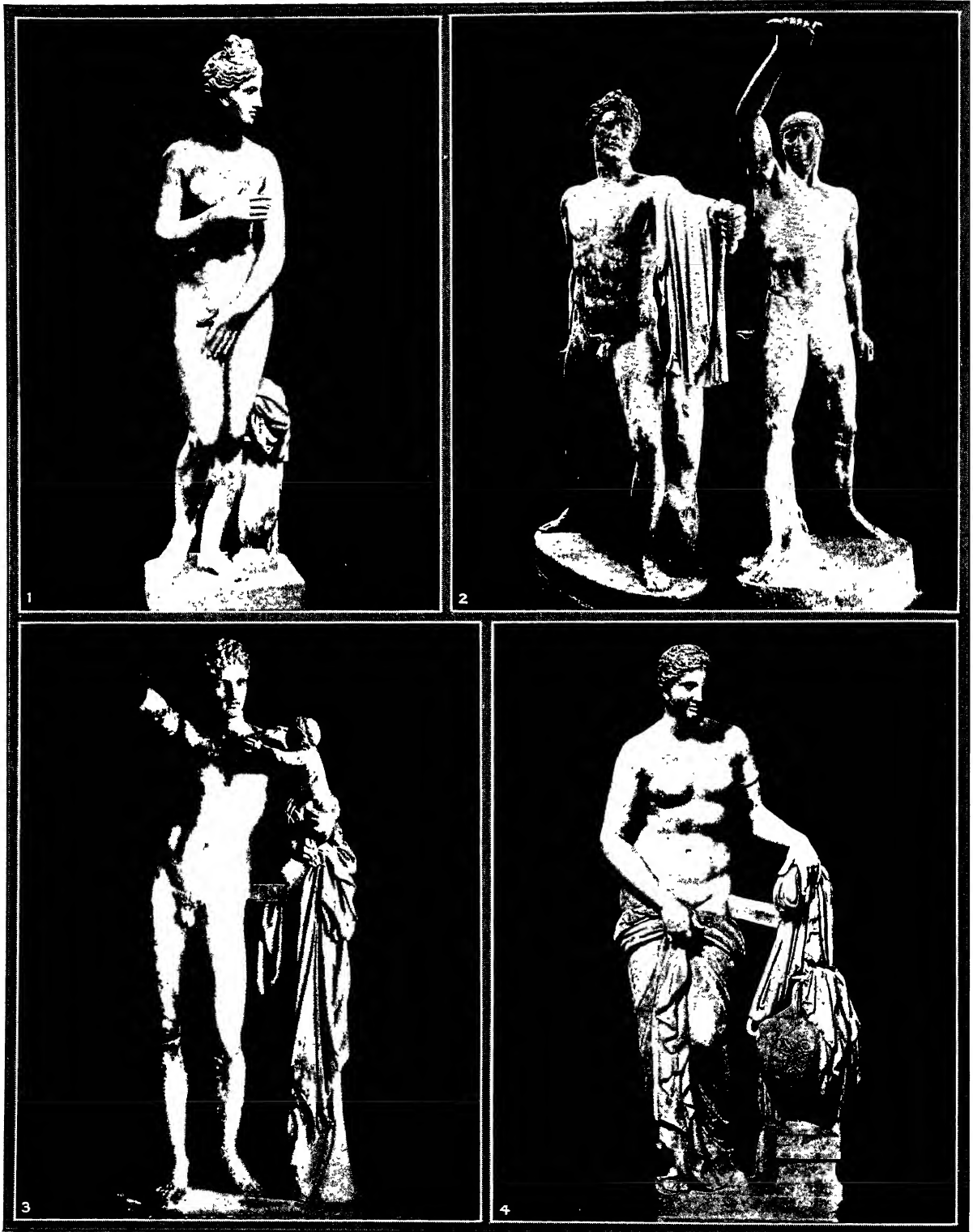


ANCIENT GREEK SCULPTURE

1. Kouros type figure of the Attic School, from the fourth quarter of the 6th century B.C. 2. Diadoumenos, by Polykleitos, Roman copy in marble found at Delos in 1894.

3. Attic Kouros type statuette, of the 6th century B.C. Statues 1, 2 and 3 are in the National Museum, Athens. 4. The Juno of Samos (16th century B.C.), in the Louvre, Paris.

SCULPTURE



CLASSICAL GREEK SCULPTURE

1. Venus in the Museo Torlonia, Rome. 2. Harmodius and Aristogeiton, slayers of the tyrant Hipparchus, in the Naples Museum. 3. Hermes with the infant Dionysus, by Praxi-

teles. This famous work of the 4th century B.C. was found at Olympia and reconstructed. 4. Venus of Cnidus, a replica of the statue by Praxiteles, in the Vatican, Rome.

SCULPTURE



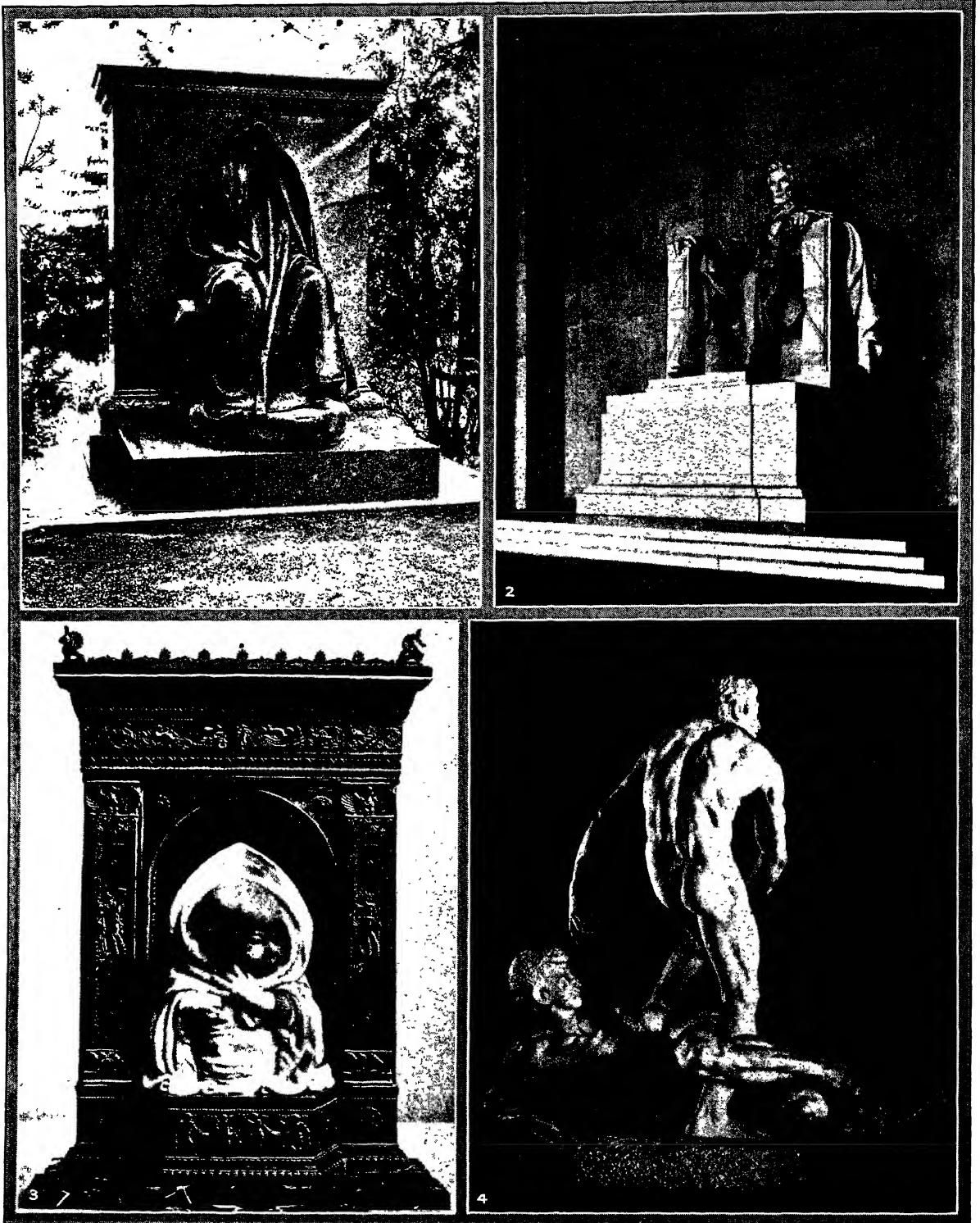
1, 2, 3, COURTESY METROPOLITAN MUSEUM OF ART; 4, C. T. LOO, ESQ.

CHINESE SCULPTURE

1. Maitreya, the Buddha yet to be born, a figure of the Wei dynasty, dated 486 A.D. 2. Stone stele Buddha between two bodhisattvas, Wei dynasty, 220-264 A.D. 3. Bronze and gilded

statuette of the goddess Kwannon-Sui (589-618 A.D.). 4. Life-size seated figure of a wooden bodhisattva, Northern Sung dynasty.

SCULPTURE



1. CHARLES PHELPS CUSHING PHOTO; 2. COPYRIGHT PUBLISHERS' PHOTO SERVICE

MASTERPIECES OF AMERICAN SCULPTURE

1. Memorial to the Wife of Henry Adams in Rock Creek Cemetery, Washington, D. C., by Augustus Saint-Gaudens (1848-1907). 2. The Lincoln statue in the Lincoln Memorial at Washington, by Daniel Chester French (1850-

1931). 3. "Pauline Frances," by Paul Manship (1885-), in the Metropolitan Museum of Art. 4. "Struggle of Two Natures in Man," by George Grey Barnard (1863-), in the Metropolitan Museum of Art.

Every little town and every period has its great gods whom they call artists and who pass into oblivion with the next generation. America has its share; but in seriously writing of sculpture it is best to ignore them, for in the end they have no meaning. Official atrocities flourish in all European countries, but that has not prevented the development of a Lemberch, a Brancusi, a Maillol. And in America there are a few sculptors of real value by whose work this age will be remembered when all the rest have been forgotten.

W. Z.

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SCUPPAUG, or scup, a name commonly applied to the Porgy, a small spiny-rayed fish abundant on the Atlantic coast from Virginia to Cape Cod and much valued as a pan fish.

SCURVY, a metabolic disease due to the absence from the diet of the vitamin designated as water soluble C. This vitamin is present in many fresh fruits and vegetables. It is destroyed by combination with oxygen, which occurs upon heating, and is not stored to any great extent in the body. Scurvy is an old disease, probably first described by Joinville in the year 1260. Cockburn in 1696 observed that sailors living on salt meat and flour developed the disease, but that it was promptly cured by eating green vegetables.

The disease is characterized by anemia, great weakness, and a tendency to hemorrhages into the various tissues. The bones become somewhat softened and fragile. The abnormality back of the disease is the inability of the connective tissues to produce those substances which bind the cells together.

The earliest symptoms are loss of weight, weakness and dizziness, followed by pains in the legs and muscular stiffness. The gums swell, become spongy and bleed easily. Unless relief comes through a change in diet, death occurs.

In infants the chief symptom is pain and tenderness at points where blood clots form about bones. (See also CHILDREN, DISEASES OF: Digestive and Nutritional Disorders.)

Treatment consists in the administration of orange juice, tomato juice and lemon juice, and a change in the diet with an increase in the amount of all fresh vegetable foods. See also BERIBERI; METABOLISM.

W. I. F.

SCUTAGE. Feudal vassals owed personal military service to their lord. Some form of commutation in money for this obligation is found in England under Henry I. Henry II levied a tax called scutage, "shield money," in lieu of service, first on ecclesiastical fiefs and later, in 1159, on all his English vassals. We see here how a feudal service could be transformed into an arbitrary land tax which gave the king a money revenue. MAGNA CARTA stipulates that scutage is not to be levied except by the barons'

consent. The last collection of scutage is in the late 14th century. This tax was formally abolished in 1660.

SCUTARI, locally Shkodër, a town of northern ALBANIA, beautifully situated amidst high mountains near Lake Scutari, whose clear green waters and rugged, mountainous shore make it one of the most beautiful in Europe. Although Scutari is the see of a Roman Catholic archbishop and has a cathedral and a Jesuit college, it looks like a Turkish city, with mosques, a bazaar and many other Turkish features. In ancient times Scutari was the capital of an Illyrian king. In the 7th century the Serbians captured it, and later it became the capital of the Norman family Balsha. It was held in turn by the Venetians and by the Albanian patriot Skanderbeg. From his death in 1467 to its capture by the Turks in 1479 Scutari was again under Venetian rule. It was not redeemed from the Turks until the Balkan War of 1912 when the Montenegrins captured it, only to cede it a year later when it was incorporated in the Albanian state. The chief trade of Scutari is in hides, wool, tobacco, horses, cattle and sardines. Weapons inlaid with metal are wrought here. About half the inhabitants are Roman Catholic and the rest are Greek Orthodox and Moslem. Pop. 1930, 29,209.

SCUTARI, city in Asiatic Turkey. See USKUDAR.

SCUTARI, LAKE, in the Balkan Peninsula, partly in Albanian and partly in Yugoslav territory. Scutari is one of the most beautiful lakes in all Europe. It stretches from the Albanian town of Scutari in the south close to the old Montenegrin capital, Cetinje, in the north. Its length is 30 mi., its maximum width 5 mi. and its depth 25 ft., though there are occasional depressions or holes which reach a depth of 150 ft. Near the Montenegrin port of Plavnitza the lake is entered by the River Moratcha, while in the south, close by the city of Scutari, issues the Boyana River, which empties in the Adriatic a short distance away. Lake Scutari is noted for its clear green waters and for the gaunt rugged mountains which surround it. It abounds in fish and aquatic birds.

SCUTUM (gen. *Scuti*), the shield, a small constellation between Aquila and Sagittarius. It is devoid of bright stars but contains one of the brightest patches of the Milky Way, well visible on summer evenings. See STAR: map.

SCYLLA, in Greek mythology, a six-headed sea monster with 12 feet and the bark of a dog, sometimes represented with dogs' or wolves' heads. She lived in a cave on a rock near the Italian shore, in the Sicilian Strait, opposite CHARYBDIS, the monster who dwelt on the Sicilian side of these waters. Scylla snatched and devoured sailors who passed too close to her. She was said to have been a sea nymph, changed into a monster by Circe's jealousy.

SCYLLA AND CHARYBDIS, dangerous cliffs between Italy and Sicily, sometimes said to rise on either side of the Straits of Messina. In the mythological legend, chiefly embodied in Homer's *Odyssey*, Scylla, a 12-footed, 6-headed she-monster with three

rows of teeth, dwelt in the cave formed by the rocks on the Italian side. Across on the Sicilian side, under a tree, lived Charybdis, another fearful female creature who three times each day swallowed up the waves and three times let them out. Scylla symbolized a wreck while Charybdis symbolized a whirlpool. Navigation between these rocks was extremely dangerous, hence the saying "between Scylla and Charybdis" to indicate evil alternatives in which one gets caught no matter which way he turns.

SCYTHIA, an ancient geographical region between the Carpathian Mountains and the Tanais, now the Don River, covering, said Herodotus, a territory about 400 sq. mi. in southeast Europe. It is uncertain as to whether the Scythians were of Indo-European or Mongol stock. They were a nomadic people cruel and filthy in their habits. Although unorganized, their methods of warfare nevertheless made them difficult to subjugate. This Darius learned when he tried to bring them under the Persian yoke in 507 B.C. To a certain extent they recognized the leadership of that band known as the Royal Scythians, and those farthest to the west, influenced by the Greek settlements on the Euxine, began to acquire the habits of agriculture. Three of these tribes of Hellenized Scythians figured in Herodotus as "The Scythians who are ploughers," "the Scythians who are husbandmen," and "the nomad Scythians who neither sow nor plough at all." Their territory later comprised European Sarmatia, and some of them pressed on into Asia as far south as India, the Juts and the Rajputs probably being their descendants.

SEA, a general term for that portion of the earth's surface which is composed of salt water and covers an area of about 143 million square miles or 72% of the entire surface. In physiography sea has come to mean chiefly the smaller subdivisions of the water surface, the three main units being called OCEANS. Inland bodies of water which are not in open communication with the oceans are called LAKES, with the exception of some in which the water is salty, such as the Caspian and the Dead seas. Seas exist on the borderline between the continents and oceans and may be divided into enclosed seas and fringing seas. The former have only a small number of rather narrow channels of communication with the ocean, as in the case of the Mediterranean and the Red seas. The latter are bounded by the continent on one side, but marked off by a series of islands on the other side, such as the Japan Sea and the Bering Sea. Seas are shallow compared with the oceans, and of more recent origin.

SEA ANEMONE, the popular name for members of a subclass (*Actiniaria*) of flower animals (*Anthozoa*) related to the corals. They are the most familiar of polyps, for many species are found in the shallow shore waters of every sea. Others are deep-sea forms, which live at a depth of more than three miles.

Common anemones are brown, yellow, pink, red, green or whitish in color. Small species are less than 1/3 inch in diameter, while large ones are over two

feet in width. Most of them are fairly large. As with other polyps, the body of an anemone is, in principle, a cylinder, with a mouth surrounded by tentacles at one end. The tentacles bear stinging cells with which the animals paralyze such prey as small sea worms and shrimps. Unlike the corals the anemones have no skeleton; they do not form colonies, and they can move about. Usually, however, they remain quietly in one place, and eat whatever passes within reach of their tentacles.

They are able to multiply both sexually and asexually. In asexual reproduction some anemones are divided by a horizontal fissure into two portions which grow into new individuals. In other cases pieces of tissue from the base of the parent are separated off, and become complete animals. See also CORALS.

SEA BASS, the name for a numerous family (*Serranidae*) of spiny-rayed, perchlike fishes comprising some 400 species found in all warm seas, a few ascending fresh waters. They are characterized by their elliptical, more or less compressed bodies, by the presence of 24 vertebrae in the backbone, and by having 3 anal spines; many are handsomely marked and colored. Carnivorous in habit, the sea basses are powerful swimmers and leapers, many ranking high as game fish. The well-flavored flesh of the larger species is excellent food. The common or black sea bass (*Centropristus striatus*), a noted game fish and also highly esteemed for the table, ranges from northern Florida to Cape Ann. It is dusky in color, more or less mottled and streaked, and attains an average length of about 18 in. and a weight of 3 lbs. In 1929 the total catch in United States waters was 4,648,000 lbs. valued at \$219,000. Other well-known members of the sea bass family are the jewfishes, groupers and niggerfishes. See GROUPE; JEWFISH; ANGLING.

SEA CUCUMBER, the popular name for members of a class (*Holothuroidea*) of echinoderms, many of which much resemble the vegetable from which they take their name, while others are more like worms. Most of them live in fairly deep shore waters, but some are found in shallow water, and others are true



SEA CUCUMBER

deep-sea animals. They have leathery skins, usually studded with tiny calcareous plates or spicules, and around their mouths nearly all of them have a ring of tentacles.

Very seldom do sea cucumbers display much energy. Some forms creep slowly about the bottom of the sea among the rocks, catching tiny organisms

with their tentacles or fanning them into their mouths. Others, especially the deep-sea species, burrow in the sand and mud, and eat organic matter intermixed with vast quantities of débris. Only when they are frightened do they become active. If they are caught they may contract first their longitudinal muscles, making themselves short and fat, then their circular or transverse muscles, making themselves long and thin, so that an enemy has great difficulty retaining his grasp. They can eject portions of their own digestive tracts, which soon grow anew, and some of them secrete a gelatinous substance which swells and breaks into threads in the water, entangling the enemy. Many sea cucumbers are edible. Their flesh, when prepared for food, is known as *BÊCHE-DE-MER* or trepang.

SEA DAHLIA (*Leptosyne maritima*), a handsome perennial of the composite family, cultivated for its showy, bright-yellow, dahlia-like flowers. It is native to the coast of southern California. The stout stems, much-branched above, grow 1 to 3 ft. high, bearing smooth, somewhat fleshy, much-divided leaves, and solitary long-stalked flower-heads, 2½ in. across.

SEAHORSE, a genus (*Hippocampus*) of very curious small fishes of the pipefish family (*Syngnathidae*), numerous in all warm seas. They have a much compressed body, tapering abruptly into a long, coiled, prehensile tail, and a head shaped somewhat like that of a horse and bent at a right angle to the body, which is more or less covered by rings of bony, spiny plates. Seahorses are found in shallow grassy bays or in the open sea, swimming through the water with the body erect, and resting usually by curling the tail about the eel-grass or seaweed. They feed on minute marine animals. The male receives the eggs in a pouch under the abdomen, where they are retained until the young fish are hatched and capable of providing for themselves. The common seahorse of the Atlantic coast (*H. hudsonius*), ranging from Cape Cod to Charleston, is about 5 in. long and usually brownish in color. See also PIPEFISHES.

SEA KALE (*Crambe maritima*), a smooth, fleshy, light green perennial of the mustard family cultivated for its spring shoots and leaves, which, when blanched, are used as a potherb. It is native to sea-coasts and cliffs in western Europe and on the Black Sea. The plant grows about 2 ft. high, with branching stems, large, somewhat cabbage-like basal leaves, and showy panicles of white flowers.

SEAL, any animal not a walrus, of the order *Pinnipedia*. Seals are marine carnivorous mammals anciently descended from land-dwelling ancestors. The seals have acquired a somewhat fishlike form by elongation of the typical mammalian skeleton, by shortening the limbs, and by having the hands and feet encased in flesh and skin, converting them into swimming organs. The body is hairy and furry, and a layer of fat beneath the skin provides warmth. Seals exist in all oceans, and also in a few large lakes formerly connected with the sea.

The species are numerous and are divided into two families, true or hair seals (*Phocidae*), and eared or fur seals (*Otariidae*). The former have no external ears, the coat is harsh, and the hind limbs are so closely united as to be useless for locomotion on land; they live mainly in arctic waters. The latter have external ears, extended limbs useful in climbing on land, and furlike coats. All seals live on fish, mollusks, and other marine food, and resort to land or ice-floes for breeding purposes. In various ways most species are useful to mankind. See FUR-SEAL; ELEPHANT SEAL; SEA-LION; WALRUS. E. I.

SEALING. While all animals of both the true seal family, *Phocidae* and the *Otariidae*, popularly called seals, are hunted, two have especial commercial value: the hair seal and the fur seal, really the sea bear.

The hair seal inhabits Alaska, the Pacific Coast states, Greenland and Newfoundland, the latter being the principal commercial fishery. In the spring, sturdy vessels put out from St. John's, anchor near productive fields, and the men shoot or club the young seals on the ice. The skins are removed with the blubber, and on the return voyage, the blubber is separated and the oil in it removed. This seal oil is used for manufactures, lighting and lubrication, and the hides are valuable for leather. In 1926, 211,531 Newfoundland seals were taken, and in 1928, 227,002.

Along the islands off South America and Australia, the fur seal has been practically exterminated by pelagic sealing, which kills southward-swimming females and their unborn young, leaving their pups to starve. There is a protected herd on Lobos Island, in the La Plata River, and another on the Cape Horn Islands. Two major northern groups have survived and are now increasing: the Bering Sea herds of the Pribilof Islands and those of the Commander Islands, Russia. There is also a Japanese herd centering on Robben Island.

In 1867, the Pribilofs became United States property. Before that date, Russian seal takings had reached 75,000 annually. Leased for twenty years to the Alaska Commercial Company, the land catch totaled thenceforth about 1,000,000 a year, while it is estimated the destructive and cruel pelagic sealing accounted for 350,000 annually. The seizure of Canadian sealing vessels precipitated the Bering Sea Arbitration of 1893, decided in favor of Great Britain, with limitations which proved no real protection. In 1910 the United States took over the industry and suspended all commercial catches. In 1911 the North Pacific Sealing Convention, between the United States, Great Britain, Japan and Russia, ended pelagic sealing and provided for a pro rata international distribution of skins from the Pribilofs.

Today, government sealing operations are confined to separate beaches where the young males "haul out." In June and July, these 3-year-old bachelors are driven to killing grounds, desirable specimens clubbed and unsuitable ones freed. The dead animals are skinned and their hides salted, cured and shipped to St. Louis,

Mo., for dressing and dyeing. There the long outer hairs are removed, and the skins graded, inspected and auctioned. In 1912, 3,191 skins were taken from a herd of 215,738, while in 1931, 49,524 were taken from a herd of 1,045,101.

SEALING WAX, a resinous substance which when melted and allowed to cool becomes hard, brittle and has good adhesive properties. It was originally made essentially of beeswax, but there are now various types in common use. Ordinary sealing wax as used in sealing documents, etc., is now made essentially of shellac and turpentine, colored with vermilion. For lower grades, earthy materials such as chalk and carbonate of magnesia are added in considerable quantities and rosin is often used in place of shellac. The desired coloring is obtained by the use of various mineral pigments.

SEA-LION, a pelagic animal of the eared-seal family (*Otariidae*). Sea-lions include the largest marine animals except whales and walruses; the males, 10 ft. long in the largest species, far exceed the females in size. Several species are known, two in the



STELLER SEA-LION

North Pacific and others from California to Patagonia. They are not closely allied to the true seals, and should be called sea-bears.

The best-known species is the Californian sea-lion (*Zalophus californianus*), which occurs numerously from Mexico to Japan, and is seen and heard barking on reefs off the bay at San Francisco or at Santa Catalina Island. Specimens, often performing ones, are exhibited in zoological parks. Sea-lions are polygamous, and resort in herds to rocky islands and shores to bear their young. They feed wholly on fish, squids and crustaceans, and in some places are said to diminish the catch of the salmon fishery by their voracity. Their coat is not useful as fur, but the hide makes fair leather and the flesh is edible. Steller sea-lion (*Eumetopias jubata*), much larger and less common than the Californian species, occurs from Bering Straits southward to central California. See FUR-SEAL.

SEA LUNGWORT (*Mertensia maritima*), a smooth perennial of the borage family, called also sea bugloss and oyster plant. It is found on sea beaches from Massachusetts to Newfoundland and

Greenland, and from Oregon to Alaska; it grows also in northern Europe and Asia. The much-branched, spreading stems bear thick leaves and small blue, whitish or rose-pink flowers in loose clusters.

SEAM, a bed of mineral or rock laid down in a blanket-like DEPOSIT by water, such as SALT, or by vegetable growth, such as COAL. In general, seams are of great area and comparatively small thickness, the thickness remaining more or less constant, but usually thinning out gradually towards the edges of the deposit. In metal mining, seam is often used synonymously with a small VEIN. See also MINING, COAL.

SEA OTTER (*Enhydra lutris*), the largest of the otters, now almost extinct. Sea otters are found only on rocky islands off the coast of Alaska and Kamchatka. For years they were slaughtered by seal hunters and fishermen, but they now have some measure of protection. Sea otters, from 4 to 5 ft. long, resemble their smaller land relatives. They live on clams, mussels and crabs. The female bears a single young one at a time. The fur varies from golden brown to almost black, and is exceedingly thick, soft and durable.

SEA PEN, the popular name for the colonies formed by members of a family (*Funiculinidae*) of coral, or Anthozoan polyps. A completed colony is shaped like an old-fashioned quill pen. It has a short central stalk, and a long, slender upper part, called the rachis, which bears branches corresponding to the barbs of a feather. On these branches are the living polyps which make up the colony. In one species (*Funiculina armata*), found in water from 600 to 2,400 ft. deep between Newfoundland and Nantucket, the polyps themselves are deep purple, while the rachis is yellow and brown. The colony may be two feet long.

Sea feathers (*Pennatulidae*), which are closely related to sea pens, and often called by their name, are similar in form except that the rachis is wider and more plume-like. They, too, are often beautifully colored. A common form (*Pennatula aculeata*) in water from 600 to 3,000 ft. deep, on the coasts of the United States and Europe, is deep red with a rose stalk, which shades off toward white at its base. Both sea pens and sea feathers can move about. Their stalks are ordinarily buried in the sands or mud of the ocean floor. See also CORAL.

SEA PINK, a genus (*Statice*) of perennial herbs of the leadwort family several of which are grown in rock gardens and as border plants. Some 50 species have been described, natives of north temperate regions and of southern South America. They are fleshy, stemless plants, producing a basal rosette of narrow evergreen leaves and a slender flower-stalk which bears small, usually pink flowers in dense globular heads. The common sea pink or thrift (*S. Armeria*), found widely on sea coasts and mountains, is extensively cultivated for its pink, purple, or white flowers.

SEAPLANE, an AIRPLANE having a water landing gear which is not incorporated in the body, thus differing from the FLYING BOAT whose hull serves

both to support the craft on the water and to house the crew and major equipment. Frequently, airplanes are of the convertible type, that is, a land undercarriage may be substituted for the pontoon or SEAPLANE FLOATS. The Douglas airplanes in which Army officers flew around the world were of this class. Seaplanes may have single or twin pontoons. With the former, small floats near the wing tips serve to give lateral balance. *See also* AMPHIBIAN.

B. C. B.

SEAPLANE FLOATS, water-going landing gear for heavier-than-air craft. These floats must be light, strong, seaworthy and airworthy. Seaworthiness requires adequate stability while on the water, combined with minimum water resistance. Airworthiness requires proper aerodynamic characteristics. *See* AERODYNAMICS.

Accepted float arrangements comprise: central float or boat with tip floats or sponsons for lateral stability; twin floats with inherent lateral stability; or triple floats comprising the central float type with larger tip floats closer in and usually contributing buoyancy.

Seaplane float resistance is favorably affected by hydroplaning properties and by wing lift. With good floats the maximum resistance occurs at about 30% of "getaway" speed.

The following features are characteristic of present design practice: "V" bottoms, straight line or hollow to reduce spray and shock; rocker keel to permit air control of longitudinal attitude after planing is attained; a main step at or slightly to rear of the center of gravity and at the lowest point; sometimes a second step on long tail floats; and a streamline plan form. *See also* SEAPLANE.

H. C. R.

SEA POWER, ability to make a nation's influence exerted at sea not only to uphold and enforce its rights on the seas the world over, in war or in peace, but to deny the free use of the seas to an enemy. The term has come into general use and acceptance since the writings of the late Rear Admiral A. T. Mahan, U.S. Navy, particularly his great work *The Influence of Sea Power on History*.

As nations rise from time to time and gradually possess themselves of navies of size and force, they are recognized as sea powers and they are listened to when questions as to Freedom of the Seas, Sovereignty of the Seas, Rights of Neutrals and other subjects of equal import are being discussed.

The history of sea power is one of contests between nations themselves largely naval. It is largely a narrative of violent contests between such nations that frequently ended in war. The profound influence of sea commerce upon the wealth and strength of countries was clearly seen long before the true principles which governed its growth and prosperity were detected. In order to secure to one's own countrymen a disproportionate share of such benefits, every effort was made to exclude others, either by the peaceful legislative measures of monopoly or tariff regulations, or when these failed, by resorting to violence to gain ends. The desire to appropriate the larger share of

commerce or trade brought on the clashes of conflicting interests. There is no doubt that wars arising from other causes than trade and commerce have been modified by sea power. The sea is a great highway over which ships may pass in all directions; but well-known sea paths show that controlling reasons have led seamen to choose certain lines of travel, called trade routes, rather than others. Travel and traffic by water has always been cheaper than by land.

A study of history shows that from the very beginning of contests in the eastern Mediterranean, through the Punic Wars, and on down through the days of the Anglo-Dutch War, the Great Britain-Spanish War, the Seven-Years' War, and the maritime wars since 1778, the results gave the major trade of the world to the strongest sea power country.

The five leading contests that affect the sea power of nations are geographical position; physical conformation; extent of territory; population; and character of government. Each successive war brings into play the efficacy of sea power and its great possibilities for offensive and defensive action.

R. E. C.

SEARCHLIGHT, a light projector consisting of a light source of high intrinsic brilliancy at the focus of a parabolic reflector. The reflectors are generally of silvered glass, sometimes of polished metal. Three types of light sources are sufficiently bright for searchlight use: concentrated-filament incandescent lamp, carbon arc and high-intensity arc. The most powerful searchlights are used for coast defense and anti-aircraft operations. These reflectors are 60 and 80 in. in diameter and they have high-intensity arcs giving about 1,000,000,000 beam candlepower. Naval searchlights are from 18-36 in. in diameter, while marine searchlights for navigational uses are 12-24 in. in diameter. *See also* LIGHT PROJECTION.

P. R. B.

SEARCH WARRANT, an order of court requiring the officer to whom it is addressed to search the house, or other property, specified, for the original purpose of finding goods illegally kept therein. Originally search warrants were used only for the purpose of discovering stolen property, but under the modern practice they have been extended, especially in liquor and narcotic cases, to cover all sorts of illegal goods.

F. K. B.

SEA ROBIN, the common name applied to a family (*Triglidae*) of peculiar spiny-rayed fishes, with very large pectoral fins in front of which are three finger-like rays used in exploring sandy bottoms. *See* GURNARD.

SEA ROCKET, a small genus (*Cakile*) of maritime plants of the mustard family. There are four species found along sea and lake shores in Europe and North America. They are low, smooth, fleshy annuals with widely branching stems bearing narrow leaves, lilac-purple or white flowers and fleshy two-jointed pods. The American sea rocket (*C. edentula*) grows in beach sands along the Atlantic and Pacific coasts and also on the shores of the Great Lakes.

SEA-SERPENT, a gigantic, and as far as is known, mythical, monster of the deep. Many fanci-

ful tales have come to us from earlier days of great sea-snakes which ravaged sea coast settlements and sailing vessels, feeding on man and animals. Several sorts of ocean creatures have misled people into believing they were seeing sea-serpents. Two basking sharks, 30 ft. long, swimming one behind the other, or a school of dolphins traveling single file, under some conditions produce the illusion of a large snake swimming through the water. The 60-ft. giant squid, often seen off the coast of Newfoundland, which has enormously long snake-like arms, was so frequently mistaken for a serpent that it earned the name of American sea-serpent. It is open to any one to believe that the deep sea, which still guards most of its secrets, may contain a real sea-serpent, but, if so, it is most certainly not the man-eating monster of legend.

SEASHORE, CARL EMIL (1866-), American psychologist and educator, was born at Mörlunda, Sweden, Jan. 28, 1866. He graduated at Gustavus Adolphus College in 1891 and at Yale University in 1895. The latter year he was appointed assistant in the Yale Psychological Laboratory. He joined the faculty of the University of Iowa in 1897, serving from 1897-1902 as assistant professor of philosophy, and after 1902 as professor of psychology. He was made head of the department of psychology and philosophy in 1905 and three years later he was appointed dean of the graduate college. In 1911 Seashore served as president of the American Psychological Association. He was the department editor of psychology of the National Encyclopedia, 1932. His works include *Elementary Experiments in Psychology*, 1908, *Introduction to Psychology*, 1922, and *Living and Learning in College*, 1927. He became widely known for his researches into mental causes underlying fatigue and illusion, and for his inquiries into music psychology.

SEA-SICKNESS, a combination of symptoms due to movement of the ship and the difficulty of adjustment to it. The eyes, the semicircular canals of the ears and all the other senses may be concerned in it, particularly the semi-circular canals which play a part in maintaining the equilibrium or balance of the body.

The symptoms of sea-sickness are general discomfort, nausea, headache and increase in the amount of saliva, soon followed by retching and vomiting. Usually there is constipation, but there may be diarrhea. Loss of appetite is common and there is often paleness of the skin. The duration is rarely more than a few days, and recovery is rapid. In extreme cases, there may be severe collapse.

To lessen the chances for sea-sickness, the diet should be simple for several days before starting the voyage, and the bowels freely opened.

When the disorder occurs, the individual should remain on deck, if possible, since the fresh air stimulates and staying up helps psychologically. In severe cases the sufferer should remain in bed and should keep warm. After the acute features are over, recovery is hastened by getting out into the fresh air. See also AIR-SICKNESS.

W. I. F.

SEASIDE, a summer and winter resort in Clatsop Co., northwestern Oregon, situated on the Pacific Ocean, 125 mi. west of Portland. A railway, bus and truck lines serve the town. Lewis and Clark visited here, led by the Indian woman guide, Sacajawea. Nearby is the first Protestant church built west of the Rockies. Seaside was incorporated about 1900. Pop. 1920, 1,802; 1930, 1,565.

SEASIDE HELIOTROPE (*Heliotropium curassavicum*), a smooth fleshy maritime plant of the borage family. It is found on sandy seashores and interior alkaline soils widely throughout the world. The branching prostrate stems, 1 to 3 ft. long, rising from a perennial root, bear oblong leaves and somewhat coiled spikes of small white flowers with a yellow eye. In California, where it is common in alkaline lands, the plant is called Chinese pusley.

SEASIDE SPURGE (*Euphorbia polygonifolia*), a small maritime annual of the spurge family called also knot-weed spurge. It grows in sand along the Atlantic coast from Nova Scotia to Florida and is also common on the shores of the Great Lakes. The short stem bears spreading prostrate branches with narrow fleshy leaves, inconspicuous flowers in the leaf axils and wrinkled three-lobed seed pods (capsules).

SEA SLUG, the common name for shell-less marine gastropods. Most of them belong to a suborder, Nudibranchia, containing about 1,000 species, but a few forms constitute a family of a different suborder, Stylommatophora.

Many of the nudibranchs are beautifully colored—orange, red with brown or white spots, dark purple, pink, yellow, green—and they breathe by attractive feathery structures, sometimes called adaptive gills, ranged in rows along their backs, or in a circle about the anus when it is located on the dorsal surface. Other nudibranchs breathe through their skin. Some species have two pairs of horns or tentacles. Some onchidiids, which have no tentacles, are peculiar in having many eyes on their backs.

SEA-SNAKES, poisonous, marine (one Philippine species excepted) snakes (*Hydrophiidae*) abundant in the Pacific waters of the Old World and thoroughly adapted to aquatic life. They are small in size, seldom reaching 8 ft. in length. Sea-snakes are characterized by their flattened tails, valvular nostrils and general lack of laterally expanded ventral plates. Only one species, *Pelamis platurus*, has extended its range to the New World. It is found off the western coasts of South and Central America and Mexico. Although very poisonous, these creatures are docile and not greatly feared by fishermen who handle them freely. The young, with possible rare exceptions, are born alive. Sea-snakes abound in sheltered coastal waters and the mouths of large rivers but swim far out to sea where they may be seen in large numbers floating near the surface. They live on a fish diet. Their color patterns, as a rule, are alternating light and dark bands. However, *P. platurus* is uniformly black above and yellow beneath, these colors contrasting strongly along the sides.

C. H. P.

SEASONAL VARIATIONS, those fluctuations in an economic time series which occur within each year in a more or less regular fashion. They are observed in many series which reflect the results of mass action by large parts of the population. Mail order sales, department store sales, construction of new buildings are examples in which marked regularity in seasonal variations are observed.

Seasonal variations are due in part to the regular seasonal changes that take place in the weather, in part to prevalent social customs and habits such as those of gift-giving at Christmas time, taking vacations during the summer months, and the purchase of new dresses and hats at Easter time. When the influence of secular trends is removed by taking the percentage ratios of the actual data to the corresponding trend values, the seasonal variations may be isolated and measured by a process of averaging the ratios for the same months of the year over an extended period of time. The averaging process eliminates cyclical and accidental fluctuations due to other causes.

Sometimes changes take place in the nature of the seasonal variation. Such changes may be due to alterations in the basic factors involved, as when the FEDERAL RESERVE SYSTEM was established in the United States. This caused an abrupt change in the seasonal variation of interest rates. The introduction of daylight saving time affected the seasonal consumption of electricity. Sometimes the change is gradual as was the case with the seasonal variation in automobile sales. The gradual increase in the relative importance of the closed models had the effect of dampening the usual seasonal variation and spreading sales more evenly throughout the year.

D. H. D.

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SEASONS, the four main divisions of the year, caused by the fact that the rotational axis of the earth is inclined toward the plane of the earth's orbit around the sun and remains parallel to itself in space during the year. As a result each pole of the earth is turned toward the sun during half a year, and away from it the other half. Thus on June 22 of each year, the north pole is turned as much as possible toward the sun, and the northern hemisphere receives more heat than at any other time. Similarly on December 22 the north pole is turned away and the northern hemisphere receives less heat than at any other time.

The periods of greatest heat and most intense cold on the northern hemisphere do not coincide with those dates. They come rather at the times when the income of heat during the day is balanced by the outgo of heat at night. These dates are approximately Aug. 1 and Feb. 1. On account of this lag June 22 marks more nearly the beginning of summer than it does the middle. As the orbit of the earth is elliptical and the motion not entirely uniform the seasons are not quite of the same length. Spring and summer in the northern hemisphere are the longest, with 93 days each,

autumn and winter are only 90 and 89 days long, respectively.

SEATTLE, chief city and port of Washington and the Pacific northwest, situated on a tongue of land between Puget Sound, on the west, and Lake Washington on the east, 23 mi. directly northeast of Tacoma, 185 mi. north of Portland, Ore., and 965 mi. north of San Francisco, Cal. It is the seat of King Co. and covers a land area of 68.5 sq. mi. In 1920 the population was 315,312; in 1930, 365,583. The city is built on a line of hills, reaching a maximum altitude of 500 ft. above sea level, cut north and south by valleys. The harbor, Elliott Bay, is on the west side, about 144 mi. to the entrance of the Strait of Juan de Fuca. Lake Washington and Lake Union are connected to Puget Sound by a ship canal 8 mi. long, opened in 1917. The city has a water frontage of 193 mi., with piers and docking facilities for the 109 steamship lines connecting the city with China, Japan, the Philippines, Hawaii, Europe, Alaska, British Columbia and California. Water-borne traffic of Seattle Harbor in 1930 totalled 7,326,897 tons of vessel traffic, valued at \$603,818,500, and 1,450,747 tons of floated timber valued at \$5,802,988. Besides the water carriers, the city is served by the Great Northern, Northern Pacific, Chicago, Milwaukee, St. Paul and Pacific, Southern Pacific and Union Pacific railroads. Seattle records an average temperature of 40° F. in January, of 63° in July. The average yearly precipitation is 34 in.

The streets of Seattle, which total 1,704 mi., are laid out regularly, in a generally strict relation to the direct points of the compass. Numbered streets extend east and west, crossed by numbered avenues running north and south. The business district is dominated by the L. C. Smith Tower of 42 stories. Near the water front, the hills have been leveled to form a tract on which is located the Civic Center, the Public Library, containing 478,993 volumes, and the chief retail structures. The city contains 30 mi. of magnificent drives, among them Lake Washington Boulevard, extending for 50 mi. around Lake Washington. The city has 48 parks, chief among them Seward, Woodland and Washington parks, the entire system covering 2,032 acres. South of the city is snowcapped Mt. RAINIER, 14,408 ft. in elevation. Between Washington and Union Lakes is the 582-acre campus of the University of Washington, which includes the grounds of the Alaska-Yukon-Pacific Exposition held in 1909-10.

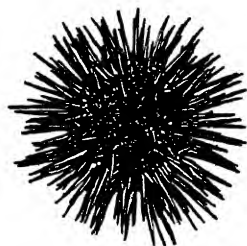
The leading industrial plants manufacture lumber products, canned goods, particularly salmon and other fish, airplanes, and marine equipment; shipbuilding is very important and also the transport industries related to facilitating the export and import traffic. In 1929 manufactures were valued approximately at \$200,000,000; the retail trade amounted approximately to \$258,940,000; the wholesale trade proper, to \$293,889,437. In 1929 the value of the wholesale trade in Seattle together with King Co. reached approximately \$577,179,125. In 1792 Capt. George Van-

couver explored Puget Sound. In 1851 the earliest group of white settlers landed across the bay from Seattle and in 1852 formed a community on the site of the present business district, naming it after a friendly Indian chief. 1869 was the year of incorporation. In 1889 most of the business district was destroyed by fire. The discovery in 1897 of gold in Alaska gave Seattle its first considerable impetus, and the completion of the Panama Canal in 1914 resulted in rapid growth as a shipping terminal.

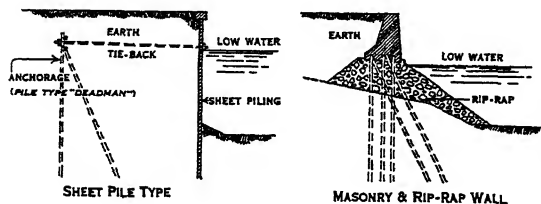
SEA URCHIN, the popular name for members of a class (*Echinoidea*) of Echinoderms. There are hundreds of species, found in every sea. Most of them live along the shore, where they are often seen in very shallow water, but some forms inhabit great depths.

A typical sea urchin looks like a ball covered with long spines or radioles. Among the spines are little pincers (*pedicellariae*) which are sometimes very poisonous. The spines and pincers are born on a hard shell or test which almost completely covers the animal. On its lower side there is a large round hole, closed over by a membrane, in the center of which is the mouth. This is provided with five long teeth, which the urchin may use as stilts for walking. Small holes in the test accommodate the tube-feet, and allow for the passage of waste material, genital products, or water for the hydraulic system.

Small sea urchins may be only 5/16 of an inch in diameter, while large ones measure about 6 inches. Many species are orange, red, green or purple; others are black, white, grey or brown. Some, instead of being globular, are peculiarly shaped, i.e., the flat sand dollars (*Echinarachnius*), the wheel urchins (*Rotula*),



SEA URCHIN

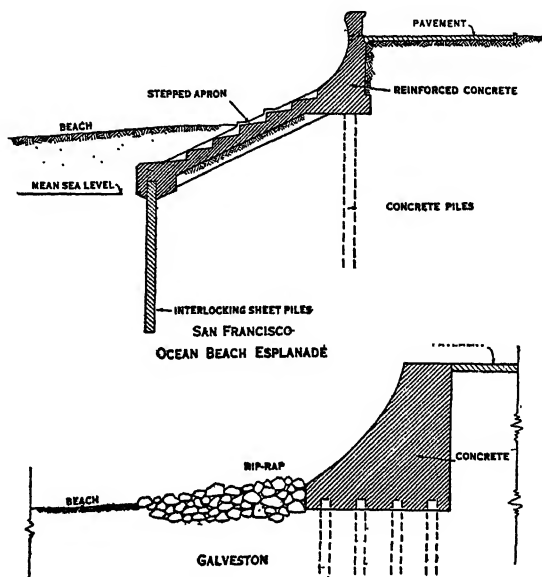


CROSS SECTION OF SHEET PILE BULKHEAD AND MASONRY AND RIP-RAP WALL

which have many projecting spokes on the edges of their tests, and the heart urchins (*Echinocardium*). The sexes are separate, and the eggs and sperm are discharged into the sea. The ripe ovaries of some species are considered edible.

SEA WALLS, walls built along the shore line to resist encroachment through wave action. Where wave and storm action is serious, sea walls should

have: 1. Strength to resist direct wave action, preferably absorbing impact gradually; 2. Height to prevent scouring behind from water overtopping the wall and falling behind it; 3. Proper design to prevent scour in front due to backwash or water falling in front, to pre-



CROSS SECTIONS OF TYPICAL SEA WALLS

vent undermining or the passage of water underneath, or "flanking" from ends or at a breach. Sea walls are constructed of timber piles, sheet piles and cribs, steel sheeting, stone and concrete masonry, and "rip-rap." See SHORE PROTECTION.

F. R. H.

SEA WATER, the water of the open oceans and seas as distinguished from fresh, or river water. The oceans contain approximately 3.5% of soluble salts and are gradually growing saltier, due to the constant influx of solid substances by the rivers and the fact that evaporation withdraws only pure water. The degree of salinity is not the same for all seas, being higher in those seas of tropical regions which have but scant communication with the ocean, such as the Mediterranean and the Red Sea. The relative proportion of the various substances in solution is the same everywhere, with the sole exception of calcium which is more abundant in deep basins. The chief constituents of sea salt are common salt, or sodium chloride, magnesium chloride, magnesium, calcium and potassium sulphate, calcium carbonate and magnesium bromide. The percentages of various elements are given below.

Symbol	Element or Ion	Amount Present
Na	Sodium	1.07 %
Mg	Magnesium	0.132
Ca	Calcium	0.042
K	Potassium	0.038
Cl	Chlorine	1.932
SO ₄	Sulphate	0.270
CO ₃	Carbonate	0.007
Br	Bromine	0.006

Since all these are in solution, and hence present in ionized condition, it is customary in the analysis of sea water to give the percentages of each of the ions, as indicated in this table.

SEA WATER POWER, WATER POWER developed from the heat energy of sea water in either tropic or sub-arctic countries. Claude has constructed an experimental plant of the tropic type near Matanzas, Cuba. Low pressure steam generated from warm surface sea water by introducing it into a boiler under partial vacuum is used to generate power in a special turbine (*see* TURBINES, STEAM) and then condensed by cold water pumped from the sea at great depth. An experimental plant of the sub-arctic type, using Barge's process, is nearing completion in Siberia. In this plant the heat energy of unfrozen water under thick surface ice will be used to evaporate a volatile hydrocarbon, the resulting gas generating power in a low pressure turbine and being condensed by exposure to blocks of frozen brine in a condenser, the supply of frozen brine being replenished by exposing the brine leaving the condenser to the cold sub-arctic air.

F. K.

SEAWEED, in a wide sense, any plant living in the sea. More specifically, a seaweed is any marine plant belonging to the botanical class ALGÆ. The most important groups are the red seaweeds, which include the most delicately beautiful of the marine algæ, and the brown seaweeds, among which are the giant kelps, the largest of marine plants. Seaweeds grow in enormous abundance especially in shallow waters and on rocks between high and low tide along tens of thousands of miles of coast widely throughout the world. A few species, as the dulce and carrageen or Irish moss, are edible and are used to a limited extent as human food and for feeding cattle. Various species of kelp were long an important source of iodine and also of potash used in making glass and soap. Kelps are now utilized chiefly as a fertilizer or manure for enriching soils along various shores, especially those of northwestern Europe.

In waters down to 60 ft. in depth along the coast of southern California the great bladder kelp, with cable-like stems sometimes 100 ft. long, forms submarine groves, many miles in extent. *See also* ALGÆ; BLADDER KELP; CARRAGEEN; DULSE; ELK KELP; IRISH MOSS; KELP; SARGASSO WEED.

SEA WRACK, a grasslike marine flowering plant of the eelgrass family common along seacoasts. *See* GRASS WRACK.

SEB or **KEB**, an Egyptian god, son of Shu and Tefnut, brother and husband of Nut, was father of Osiris, Isis, Typhon and Nephthys. Seb was the earth god with power over the lower world and tombs.

SEBASTIAN, ST. (3rd century), Roman martyr, was born in Italy in the 3rd century at the time of the Emperor Diocletian's persecutions. He is said to have been captain of the first cohort under the Emperor, who ordered him put to death upon information of Sebastian's conversion to Christianity. The writings of St. Ambrose contain a brief account

of his martyrdom. His feast is celebrated on Jan. 20.

SEBASTOPOL, a Black Sea fortress and port in the southwestern part of the Crimean Autonomous Soviet Socialist Republic, a portion of the R.S.F.S.R. With a latitude similar to that of Bordeaux, France, the city is well known as a health and pleasure resort. Hills protect it on three sides and assure it a mild climate. Although Sebastopol was only founded in the last part of the 18th century, archeological research has disclosed Greek and Roman trading sites. During 1854-55 the city was practically destroyed by the French and English. Recovery started in 1877 with the establishment of railway communication to Moscow. The port with its fine harbor is almost wholly military, the only considerable export being grain. A number of small factories produce machinery, food, leather goods and soap. Several museums and a notable biological station are located here. Pop. 1926, 74,703.

SEBASTOPOL, a town in Sonoma Co., northwestern California. It is situated 7 mi. southwest of Santa Rosa and served by the Northwestern Pacific and the Petaluma and Santa Rosa railroads. The surrounding region has large fruit farms, chiefly of apples, cherries, pears and grapes. It was near Sebastopol that LUTHER BURBANK carried on his nursery gardens experiments. Pop. 1920, 1,493; 1930, 1,762.

SEBENICO, Serbo-Croatian Sibenik, a city beautifully situated beside the River Kerka on the Dalmatian coast, dominated by three fortresses, and belonging to YUGOSLAVIA since 1919. A street from the public garden at the wharf leads to the Gothic and Renaissance cathedral which was begun about 1430. Sebenico is the seat of a Roman Catholic and a Greek Orthodox bishop. The Loggia of 1522 is now a casino. A beautiful view is to be had from the St. Anna Fort. A ten-mile drive through the lonely grandeur of the Dalmatian interior brings one to the Kerka Falls, *Skradinski Slap*, rushing down in five breaks, surrounded by poplars, willows and olive trees. The city produces wine, oil and liqueurs. Pop. 1921, 12,588.

SEBORRHEA, a functional disorder of the skin and scalp in which there is an increase in the amount of the natural oily secretions of the skin. The skin may appear abnormally oily or too dry.

Under normal conditions, the oily secretion of the skin is made up of free fat, dry skin cells, and cells which are undergoing fatty changes. In seborrhea, either the fat elements or the dry cells may be in excess, which produces the two types of skin condi-



SAINT SEBASTIAN

From an engraving by Albrecht Dürer

tion: dryness or excessive oiliness. In the oily type, the skin has a shiny, greasy appearance, with large pores, many of which contain oil plugs, known as "blackheads." In the dry type, there is accumulation of scales or crusts on various parts of the skin.

The disorder usually responds favorably to treatment, although clearing up of the scalp may be difficult. For treatment of the non-hairy skin, X-rays, sulphur and resorcin are the most valuable. Sulphur, resorcin and mercury are used for hairy parts. The skin should be frequently cleansed with soap and water, alcohol or benzine. Any underlying constitutional factor should be remedied or removed.

SECAUCUS, a town of Hudson Co., N.J., located on rising ground surrounded by the tidal flats of the Hackensack River, 5 mi. west of New York City and adjoining Jersey City, N. J. It is served by the Lackawanna and the Erie railroads, electric trolleys and motor bus lines. Secaucus is the residence of many New York City business men and has several local industries including the manufacture of embroideries, silk and buttons. It is a trade center for an area devoted to truck-gardening and the raising of pigs. Pop. 1920, 5,423; 1930, 8,950.

SECESSION, ORDINANCE OF, the declaration enacted by the Convention of South Carolina, Dec. 20, 1860, repealing the ordinance whereby the state had ratified the Federal Constitution; followed, Dec. 24, by a Declaration of Causes explaining the motives of the convention to the world. The declaration asserted the "compact theory" of the origin of the Federal Government (*see* NULLIFICATION, RIGHT OF); affirmed that the ends for which the Federal Government was created had been defeated, "and the Government itself has been destructive of them by the action of the non-slaveholding states;" and announced that when on Mar. 4, 1861, the Republican party came into power, "the guarantees of the Constitution will then no longer exist; the equal rights of the states will be lost." By Feb. 1, 1861, Georgia, Alabama, Florida, Mississippi, Louisiana and Texas had adopted ordinances similar to that of South Carolina. On Apr. 17 Virginia submitted an ordinance to the people while Arkansas followed South Carolina's lead on May 6. The following day Tennessee concluded an alliance with the Confederacy and on May 20 North Carolina seceded by ratifying the Confederate constitution.

SECONDARY EDUCATION, a term which has hitherto connoted that type of education provided for the select few along the lines of a traditional concept of a liberal education and preparing directly or indirectly for entrance to a college or university. Generally its characteristics have been the study of foreign languages, sciences and mathematics. The age for commencing secondary education has been and still is somewhat indefinite, being 10 in Germany, 11 in France, 9-12 in England, and 12-14 in the United States. Such education in Germany is given in a variety of schools, *Gymnasium*, *Realgymnasium*, *Oberrealschule*, *Deutsche Oberschule*, and *Aufbauschule*;

in France in the *lycées* and *collèges*; in England in the so-called public schools, grammar schools and council secondary schools; in the United States in the high school.

Probably the most important problem confronting educators and statesmen to-day is first to secure closer articulation between elementary and secondary education, to provide more opportunities in all ranks of society for continued education beyond elementary, and to provide for greater differentiation of types of secondary education, which means a broader definition of secondary education adapted to modern social needs. With the decrease of occupational opportunities for adolescents and the mechanization of industry, the general trend of opinion seems to be in favor of utilizing secondary education for training for intelligent citizenship and for cultivating leisure interests.

I. L. K.

See I. L. Kandel, *History of Secondary Education*, 1930.

SECOND LIEUTENANT. *See* LIEUTENANT.

SECOND-SIGHT, a popular name for the gift of prophesy, *CLAIRVOYANCE*, or seeing at a distance by means of supernormal senses. It seems to have prevailed in Scotland, and according to folk-lore tradition, the seventh son of a seventh son or a child born with a cowl was supposed to be endowed with this gift.

SECOTAN, a tribe of North American Indians, encountered by Sir Walter Raleigh in North Carolina. They spoke a dialect of the Algonkian linguistic stock and, according to a member of the early Raleigh expeditions, were of medium height and wore loose deer-skin mantles. The men cut their hair close with the exception of a strip about two inches wide from the back of the neck to the forehead in which the hair was kept about an inch and a half long. The women's hair was clipped in front. Both men and women were tattooed to some extent. The Secotan believed in the immortality of the soul and in the existence of an eternal being or God in addition to numerous lesser deities. The largest of their villages contained about 30 houses which were of bark or rush mats mounted on an oblong framework of poles. They were expert agriculturists and fishermen.

SECRETARY BIRD (*Serpentarius secretarius*), a remarkable South African bird of prey related to the hawks, eagles and vultures. It stands nearly 4 ft. high, with a small body and very long legs, and bears a superficial resemblance to a heron or crane. The back of the head is provided with a crest of pendent plumes which have been likened to the pen behind the ear of a secretary; the middle tail feathers are also much elongated and drooping; the plumage is largely bluish gray, black and white. The secretary bird lives chiefly on the ground, using its long powerful wings only when severely pressed. It subsists chiefly upon reptiles and insects, though often catching small mammals and birds. Its huge nest, in which are laid two or three dull white, rusty-spotted eggs, is composed of sticks, clay and hair and is placed in a bush or tree.

In South Africa secretary birds are protected by law and are often kept as pets around farm houses, where, though occasionally killing young poultry, they destroy snakes, insects and other noxious animals.



SECRETARY BIRD

SECRET OF SUZANNE, THE, an opera in one act by Ermanno Wolf-Ferrari, libretto by Enrico Golisciani based on a French tale; première, Munich, 1909, Rome and New York, 1911. The opera is infrequently played.

Suspecting that his wife, the Countess Susanna, is entertaining a lover because her husband, Count Gil, smells tobacco smoke one day in their drawing-room, the latter proceeds to institute inquiry. The opera closes with the count's discovery that the countess herself smokes cigarettes.

SECRET SOCIETIES, a form of organization common to mankind since the beginning of communal living. They vary from organizations whose only secret is a pass word to those with elaborate initiation ceremonies, a private language, a badge with esoteric significance and innumerable other secret rituals all calculated to increase the atmosphere of mystery and exclusiveness. Secret societies of primitive peoples fall generally into magical, religious or social categories; a religious element is almost invariably present as the underlying motive. The natives of Africa are particularly prone to magic societies and societies which have a definite correlation to the political structure of the tribe. The majority of the American Indian tribes had secret brotherhoods, usually of a religious character. The shamanistic societies of the Plains Indians were more or less secret and devoted to healing disease. In the Southwest each Pueblo tribe had several secret societies which mediated between the members of the tribe and the zoomorphic gods. Secret societies of primitives invariably had their own dances, songs and whistles, and frequently admitted women to their ranks. A Chinese society founded in the 4th century has more members than any other secret society known. It was started for the purpose of spreading the cult of Amitabha Buddha but grew into a powerful political

cult. The MASONIC ORDER is the largest and oldest secret society in Occidental lands. There has been a long series of political secret societies in the United States beginning with the Sons of Liberty, organized in Maryland in 1764-65, from which sprang the various Tammany societies. The first of these was called the Sons of St. Tammany after an Indian Chief, Tammanend, noted for his wisdom and benevolence and dubbed "saint" in ridicule. These organizations disbanded after the Revolution but were followed by such groups as the Society of Red Men, Order of the United American Mechanics, Sons of America, Brotherhood of the Union, the Know-Nothings, the Ku Klux and the American Protective Association. About 30 secret societies have engaged in politics in America.

SECTIONALISM, a sentiment of regional solidarity such as differentiates South Germany or Wales from other areas in their respective states. It may be based upon racial stock, religion, historical tradition, or economic interest. In the United States its most obvious expression is found in the "Solid South" where the Negro question dominates politics; but the rest of the country falls into a number of fairly distinct regions according to the prevailing type of economic life, manufacturing, wheat-raising, etc. Therefore, the national parties take shape as combinations of sectional interest-groups whose diverse political inclinations must be harmonized by a process of compromise.

SECULAR TREND, the evidence of a long-time, slowly-moving and persistent force of growth or decay in a statistical time series. The causes of secular trend are to be found in changes in the basic factors that underly a particular economic phenomenon. An increase in population, the extension of a market, an increase in the standards of living, the growth of wealth in a country, technological progress, all of these are basic changes that affect different industries. When such changes result in an expansion of an industry the secular trend of production in that industry is upward. In some cases, however, the changes in the basic factors affect an industry adversely and the secular trend of its output becomes negative. For example, the gradual substitution of automobiles for horse-drawn vehicles is reflected in a downward secular trend in the production of carriages, wagons, and leather harness.

The word trend in business and economic statistics has a technical meaning. It does not refer to tendencies which may be of short-time duration. It is used exclusively to describe the long-time, persistent forces of growth or decay. Trends may be determined roughly by means of observation, by passing a moving average through the actual data, or more exactly by some mathematical process such as the method of least squares. The curves most commonly used to describe secular trends are the ordinary straight line $y = a - bx$; the compound interest curve, $\log y = a - bx$; the so-called log parabola, $\log y = a - bx - cx^2$; and the Gompertz curve, $y = ab^{cx}$.

D. H. D.

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SECUNDUS, JOHANNES (1511-36), Dutch poet, whose real name was Jan Nicolai Everaerts, was born at The Hague, Nov. 10, 1511. His best known work is a series of amatory poems in polished Latin entitled *Kisses*, 1536. He was adept in painting and sculpture as well as in poetry, but he was best known as an elegant Latinist. Secundus died at St. Armand, near Tournay, Oct. 8, 1536.

SECURITY PACT. See LOCARNO, TREATIES OF.

SEDALIA, a city in western Missouri, the county seat of Pettis Co., situated 60 mi. west of Jefferson City. Two railroads afford transportation. The vicinity is fine farming country and offers excellent pasturage for live stock. Sedalia is a commercial center. Its industrial interests include railroad shops, flour mills, packing houses and poultry dressing plants. The retail trade in 1929 amounted to \$9,983,701. The city was chartered in 1889. During the Civil War, Sedalia was a Union military post. Pop. 1920, 21,144; 1930, 20,806.

SEDAN, BATTLE OF, an encounter in the Franco-Prussian War between the German army under King William of Prussia and Gen. Von Moltke and the French under Marshal MacMahon and the Emperor Napoleon III, fought on Aug. 31 and Sept. 1, 1870, in and around the town of Sedan, France. Although the French were in a strong position, their activities in Sedan could be overlooked from the Prussian headquarters. During the battle remarkable stamina was shown by the French, but the command was changed when Marshal MacMahon was wounded, and conflicting orders contributed to defeat. The main French position was shattered, and even the lines of retreat were cut off. Napoleon III, who had withdrawn, agreed to an unconditional surrender, and was himself captured. Large quantities of guns and ammunitions became German property, and nearly 86,000 soldiers and officers were made prisoners.

SEDGES, the common name for the numerous grasslike plants comprising the botanical genus *Carex* and used also to designate the members of the entire family (*Cyperaceae*) to which this genus belongs. In the latter broader sense the sedges include also various galingales, spiked rushes, cotton grasses, club rushes, bulrushes, horned rushes and nut rushes. The family, which comprises some 3,000 species, chiefly marsh plants widely distributed throughout the world, is of slight economic importance. See also CAREX.

SEDIMENTARY ROCKS, called also stratified rocks, consist of material derived originally from pre-existing rocks by the agencies of WEATHERING and EROSION. Such material has been moved and transported by wind or water, and deposited anew by the processes of SEDIMENTATION. The deposits formed by water are by far the most important, and their compaction by weight of overlying material, formed later, or their cementation by substances deposited by circulating waters, transforms such sediments into the important sedimentary rocks, SANDSTONE, SHALE and LIMESTONE. Wind-borne sediments form the com-

paratively unimportant Aeolian rocks, and glacier-transported material may become compacted into TILLITE. Some organic substances, as COAL, are also classed as a stratified rock. See also IGNEOUS ROCKS; METAMORPHIC ROCKS; PETROLOGY; GEOLOGY; STRATUM; SEAM; STRATIFICATION; STRATIGRAPHY.

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SEDIMENTATION, the settling of very small solid particles that are suspended in a liquid or gas. In chemical and metallurgical engineering practice, sedimentation is commonly used to separate a thin suspension of solid particles in a liquid into a thick slurry and a comparatively clear liquor by allowing the suspension to stand undisturbed in a tank. The particles settle to the bottom and are drawn off as a *sludge*, while the clear liquor is decanted from above the sludge through a suitable draw-off pipe. Apparatus has also been developed that will carry out the above process continuously. W. L. McC.

SEDIMENTATION, in geology, the process whereby DEPOSITS are formed, usually beneath water through the dropping of material it carried in solution or suspension. This process is one step in the never-ending cycle of destruction, scattering and reconstitution of the rocks of the earth's crust. Through WEATHERING and EROSION, igneous, sedimentary and metamorphic rocks exposed at the surface are broken down, their constituents washed into streams and rivers, and there carried toward the ocean, both as salts in solution and as silts and sands in suspension. As the flowing water loses velocity, and hence carrying power, its load of sediment is dropped, coarse material first, then SAND, with the fine, impalpable SILT retained to the last. When this takes place along a river's course, fertile, alluvial flood plain deposits are formed. Where a stream empties into lake or sea, much of its load is deposited in the DELTA, with the finer material carried further out. In the ocean a more rapid deposition of the fine silt in colloidal suspension is brought about by the flocculating action of the dissociated salts in sea water. The compaction of these various deposits produces the SEDIMENTARY ROCKS, SANDSTONE and SHALE.

Besides the mechanical processes of sedimentation, chemical precipitation also occurs. The mineral matter carried in solution is often taken up and used by organisms, the most important being the secretion of CALCITE by marine animals to form shells, as of molluscs and corals, and by marine algae. Accumulations of fragmental material of this type go to form beds of LIMESTONE, the third great class of sedimentary rocks. Some limestone is also formed by direct chemical precipitation such as the oölitic limestones. Evaporation of enclosed basins is responsible for the precipitation of beds of ordinary SALT and allied minerals, of which the famous Stassfurt deposits are a classic example.

Deposits thus formed will evidently occur in fairly well-defined, horizontal beds, or strata, and are known as bedded or stratified deposits.

In certain regions sedimentation by the wind occurs. Windborne sand is often accumulated in ridges and hills, known as sand dunes, especially in deserts and along the seashore. Pushed along a few feet a year by prevailing winds, such dunes are known to overwhelm villages and forests. Thick deposits of yellow to brown loam or silt, called Loess, blown from adjacent regions form fertile soils in the Mississippi Valley, the Rhine Valley, and in northern China. Wind-formed deposits are known as Aeolian deposits, and usually have a much less regular bedding than water laid ones. *See also* COLLOID; CHEMISTRY; FLOCCULATE; GEOLOGY; OÖLITE; STRATIFICATION; MINERAL DEPOSITS; PETROLOGY. S. F. K.

BIBLIOGRAPHY.—Wm. H. Twenhofel, *Treatise on Sedimentation*, 1926.

SEDIMENTATION TANKS. *See* SETTLING TANKS.

SEDUCTION, persuading a female to surrender her person for sexual purposes, as where deceit is used in connection with promises of marriage. The woman must have been in fact, not reputation, chaste. Her chastity is presumed until overcome by the weight of evidence. At common law women formerly had no action for seduction. They could sue only for breach of promise. Statutes have remedied this, but in most cases require that the testimony of the complainant be corroborated.

SEDUM, a large genus of succulent herbs of the orpine family commonly called **STONE-CROP** and **LIVE-FOR-EVER**. It comprises some 200 species found in temperate and cool regions of the Northern Hemisphere; about 30 occur in the United States. They are mostly low perennials, often creeping and rooting, with alternate, fleshy, sometimes very small and imbricated leaves and brightly colored, showy flowers in terminal, long-branched clusters. Numerous species are grown in borders and in rock gardens and also as pot plants. Among the best known are the mossy stone-crop or wall-pepper (*S. acre*), a native of the Old World very widely cultivated and naturalized; the live-for-ever or orpine (*S. Telephium*) and the **ROSEROOT** (*S. roseum*).

SEE (Latin *sedes*, seat), the seat or residential city of a **BISHOP**, where his cathedral or procathedral is situated. In some cases, however, where a see has been transferred, the name of the older see has also been retained, as in the case of the archbishops of Munich-Freising, Germany, and Gnesen-Posen, Poland. The ancient see of Meissen, Germany, has been restored since the World War, but the bishop of Meissen has his residence in Bautzen.

SEEBOHM, FREDERICK (1833-1912), English economic historian, was born at Bradford, Nov. 23, 1833. He held the offices of poor law guardian and justice of the peace. His *English Village Community*, 1883, is a notable contribution to economic history. This was followed by *The Tribal System in Wales*, 1895, and *Tribal Custom in Anglo-Saxon Law*, 1902. In this latter work Seebohm attempted to disprove the idea that Anglo-Saxon society was one of communal

groups of freemen, asserting that its origin was Roman. He died at Hitchin, Feb. 6, 1912.

SEED DISPERSAL. It is obvious that if all of the seeds were to fall and germinate immediately beneath the mother plant, competition would be so great that very few of the seedlings would survive. Dissemination is insured by the fact that plants grow a great variety of adaptive devices on their fruits and then various agencies, as wind and animals, disperse the seeds. Those carried by wind are usually light in weight and have wings or tufts of cotton or hairs. Familiar examples are the winged seeds of maples and the silky seeds of milkweeds being carried through the air. In this way they often travel many miles. The tumble weed grows spherical in form and at the time seeds are ripe the plant breaks off at the base of the stem and is then blown around over the ground. The seeds do not all become loosened from the receptacle at the same time and only a few fall at each turn, making a very effective method of distributing seeds for several months over a large area of ground. Some fruits and seeds have hooks, spines, needles or sticky secretions which make them adhere to clothing, fur, or feathers of animals, by which means they may be carried for many miles before they are dislodged. Fleshy fruits are attractive as food and birds are effective disseminators for this type. Nuts are carried from trees and actually buried by squirrels as if they were intentionally planting seeds. P. W. Z.

SEEDERS, machines for sowing seed. There are many types, most of which employ a revolving seed cup and a device to alter the rate of seeding. To sow more seed the size of the seed cup or the opening of the discharge gate is increased. A few seeders have a variable speed drive for the seed cup and changing speed effects rate of sowing.

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SEED FERNS (Pteridosperms), a term first applied in 1903 to a newly discovered and remarkable group of extinct plants, fernlike in habit and foliage, bearing highly organized seeds upon the tips of ordinary green leaves, or on naked portions of the frond. A conspicuous achievement of recent paleobotany was the establishment of the fact that some millions of years before the first flowering plants appeared, these supposed ferns, abundant in the Coal Measures, had developed seed-bearing habits. The first seed fern to be recognized was *Lyginopteris oldhamia*. It seems probable that a large proportion of Carboniferous "ferns" were seed-plants of this class. In 1920 seeds found in the oldest known petrified forest, at Gilboa, in the Catskills, carried the history of seed ferns back into Devonian times. *See also* LYGINOPTERIS.

SEEDLESS FRUITS may be grouped in two main classes. In one class the development of the fruit itself is purely vegetative or parthenocarpic and is independent of any stimulation associated with the growth of embryos and seeds. Pineapples, the seedless cucumbers, and the Washington navel orange are of this class. They produce seedless fruits when there

is no pollination and fertilization, but at least some plants of this class produce fruits with seeds if there is proper pollination. In another class, illustrated by the Thompson seedless grape (Sultanina), pollination and fertilization are necessary for the setting of seed, but the embryos abort after a few weeks while the berries continue to mature. Plants of this class produce only seedless fruits although their pollen when used in certain cross-pollinations may be highly functional in producing seeds.

Many of the most important fruits of the tropics are seedless. Seedless bananas, the navel oranges, pineapples, the Sultanina grape, and the near-seedless Marsh grapefruit and the Eureka lemon are grown and shipped in such quantity that they may be purchased in season at almost any fruit store throughout the United States. The culture and sale of seedless persimmons are being extended. The seedless bread fruits have long been a valuable food in the tropics. Thus seedless fruits already rank highly in tropical and subtropical horticulture.

In the important fruit crops grown in the temperate regions individual plants bearing seedless or near-seedless fruits have been known among hardy grapes, pears, apples, stone fruits and small fruits. Some of these have been propagated as clons and cultivated to some extent, but none have fruits of the size, quality and quantity that satisfy the demands of horticulture, although valuable types could, no doubt, be developed by proper selective breeding. Among the vegetable fruits some of the best of the eggplants, forcing cucumbers, and tomatoes are seedless or near-seedless.

Most plants which bear seedless fruits are propagated asexually as clonal varieties. In various of the parthenocarpic fruits, seeds may be obtained by proper pollination and these may be used in selective breeding or, as in the case of the seedless cucumber, in the reproduction of the variety. Seedless fruits of the parthenocarpic type are especially valuable in horticulture for there are no pollination problems involved in their culture; the fruit develops purely as a vegetative structure. Seedless and near-seedless fruits have appeared in such a wide variety of plants that the development of such fruits seems possible for any fleshy fruit.

A. B. S.

SEED PLANTS, a group name for all plants that bear flowers, followed by a seed, often called the **FLOWERING PLANTS**. See **ANGIOSPERMS**, **GYMNOSPERMS**.

SEEDS. Since seeds are formed in similar fashion in all flowering plants (see **FLOWER**), a protective testa, embryo plant and endosperm tissue are common developments. There is diversity, however, in coat characters, the degree of differentiation of the embryo organs and the amount of endosperm at maturity. In dicotyledons, a well-developed embryo consists of a tiny root or radicle, two seed leaves or cotyledons, and stem sometimes with obvious leaves, the plumule, between them (bean). Monocotyledons have all three organs, with but one cotyledon (corn). Food may all be stored in the cotyledons when the endosperm

does not persist (mustard) or partly in conspicuous hard or soft endosperm (corn, holly). Seeds represent resting structures which carry the species over both time and space. They differ greatly in the length of time they retain viability and the period of rest they undergo, since many do not respond to germinating conditions during a definite interval of dormancy. There is wide dissemination over space by such different means as wind, water currents, and living agents which carry such as are equipped with barbs or other devices that cause adherence, or which consume fleshy fruits containing seeds. Seeds are of great economic importance as food due to the reserves stored by the parent plant. These are starch or other carbohydrates with or without protein (bean) and oil (almond).

N. E. P.

SEGER, ALAN (1888-1916), American poet, was born in New York City in 1888. He was educated at Harvard, and in 1912 went to Paris. During the World War he served in the French Foreign Legion, sending accounts of his experiences to the *New York Sun* and *The New Republic*. His *Poems* were published in 1916, his *Letters and Diary* in 1917. His beautiful poem, *I have a Rendezvous with Death*, appears prophetic, for he was killed when his plane was shot down at Belloy-en-Santerre, France, July 3, 1916.

SEER, one who is capable of seeing visions by way of prophesy, or peer into the future, or in general a soothsayer.

SEES, a small town in Normandy, 15 mi. from Alençon, famous for its beautiful cathedral of the 13th and 14th centuries. Unfortunately built on unstable soil, the cathedral has many times required repairing and buttressing. In the 16th century massive supports were added to the west front, and in the 19th century the towers were rebuilt. The interior of the church is especially imposing in its harmony and in the elegance of the sculptured decoration, the arrangement of which recalls that of the cathedral of Bayeux. The town contains several notable old houses. Pop. 1931, 4,181.

SEGESTA, or Egesta, an ancient city of northwest Sicily, on the side of Monte Barbaro. Tradition regarded Segesta as founded by Aeneas. The first inhabitants were constantly at war with Selinus and in 415 B.C. induced the Athenians to join with them. Segesta was captured by the Carthaginians, and in 307 B.C. depopulated by Agatholes, but recovered and came under Rome in 206 B.C. There are few remains except the theater. The baths are 5 mi. north of the city, and the temple to the west of the town, 5th century B.C., is one of the best preserved on the island.

SEGO LILY (*Calochortus Nuttallii*), a handsome plant of the lily family allied to the tulip. It is native to dry soils from South Dakota to New Mexico and westward to the Pacific Coast. The slender stem, about a foot high, rising from a coated bulb, bears narrow leaves and white tulip-like flowers, 2 in. across, beautifully tinged and marked with pur-

ple, lilac and yellow. The edible bulbs are said to have been used for food by the early Mormon settlers in Utah who compared it to the manna which saved the Israelites in the wilderness. Because of its attractiveness and associations with the early history of the state, the sego lily has been made the state flower of Utah.

SEGOVIA, a city of Spain, capital of the province of the same name. It is picturesquely situated on a steep hill enclosed by turreted walls. It has a famous Roman aqueduct, believed to have been built in the 1st century A.D., a 16th century Gothic cathedral, a former church of the Knights Templar, a Moorish castle and several other churches and former abbeys. Leading industries include leather, cloth, glass and wool factories. Segovia was often the residence of the kings of Castile and León. Est. pop. 1929, 15,000.

SEGUIN, a city in south central Texas, the county seat of Guadalupe Co. It is situated on the Guadalupe River 36 mi. northeast of San Antonio and is served by the Southern Pacific Railroad. The city has flour, cotton, and cottonseed oil mills and a brick and tile plant. An oil field and a sulphur well are nearby. Farming and dairying is carried on in the vicinity. Four hydroelectric power dams are located near Seguin. The city is the seat of the Texas Lutheran Junior College and the Guadalupe College for Negroes. The electric, water and sewer systems are municipally owned. Pop. 1920, 3,631; 1930, 5,225.

SEICHE, a sudden oscillation, or fluctuation of water-level observed on great lakes. Seiches are ascribed to sharp variations in atmospheric pressure over different parts of the lake surface. During a seiche the entire body of water swings rhythmically from shore to shore, as water swings in a tilted hand-basin. The disturbance lasts from a few minutes to several hours, the rise and fall amounting sometimes to six feet. First recorded on Lake Geneva, Switzerland, seiches have been found to occur on all large lakes.

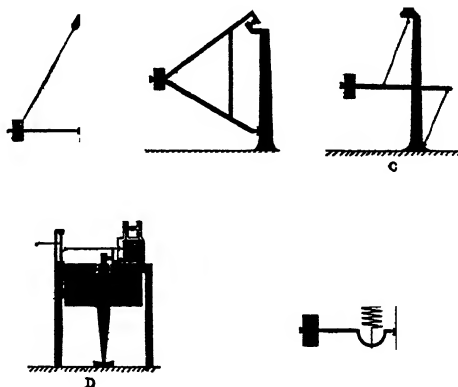
SEIGNIORAGE, usually the charge made by a government for minting standard bullion, but in some countries a charge in excess of brassage imposed for reducing GOLD containing impurities to standard fineness. Seigniorage is represented by the difference between the bullion or metal price and the nominal value of the coin. At times the U. S. Government has been able to purchase the weight of the SILVER in a dollar for 50 cents. Since silver is not entitled to free coinage but is coined for government account only, the government makes a profit which is placed in a silver profit fund. The term is a survival of the Middle Ages when kings (*seigneurs*) charged for minting coins. The leading nations make no charge for the minting of gold coins.

SEIGNOBOS, CHARLES (1854-), French historian, was born at Lamastre, Sept. 10, 1854. Educated partly in Germany, he was appointed professor at the University of Dijon in 1879. His historical works include *Le Régime féodal en Bourgogne*, 1882, *Histoire de la civilisation*, 1884-86, *Scènes et épisodes*

de L'histoire nationale, 1890, and *Histoire politique de l'europe contemporaine*, 1814-1914, the publication of which began in 1897. These works have become standard in French history.

SEINE, a river in the northern part of France, being the most important of the country's waterways draining the district known as the Paris Basin. Rising on the plateau of Langres near Dijon at an alt. of 1,545 ft., the Seine flows northwest, meeting the English Channel between Havre and Honfleur, with a total length of 482 mi., of which about 350 mi. are navigable. Its channel has been deepened so that it admits vessels of as much as 10 ft. draught to the port of Paris and in its winding course through Paris, about 8 mi., it carries approximately 10,000,000 tons of shipping a year. At Rouen, the leading city of ocean navigation, the river receives vessels of 20 ft. draught; below this point it is dyked. Beginning as a small stream, the Seine is joined by important smaller rivers, and is connected directly or through its affluents by canals with the basins of the Rhine, the Scheldt, the Loire, the Saône, the Meuse, and the Sambre. Its first considerable tributary is the Aube which flows into the Seine beyond Troyes; at Montereau it is joined by the Yonne, an important affluent from the south, here the channel is deepened from 5 ft. 3 in. to 6½ ft. The Marne flows into the Seine on the outskirts of Paris and the Eure east of Rouen, at which junction point the great river has already become tidal. Of great economic value to France the valley of the Seine is considered beautiful throughout and the region about Rouen is famous.

SEISMIC EXPLORATION, or "earth-wave survey," in geophysical exploration a method of investigating concealed geological formations by observing



COURTESY MCGRAW-HILL BOOK CO.

VARIOUS METHODS OF SUSPENDING THE HEAVY MASS OF SEISMOGRAPHS

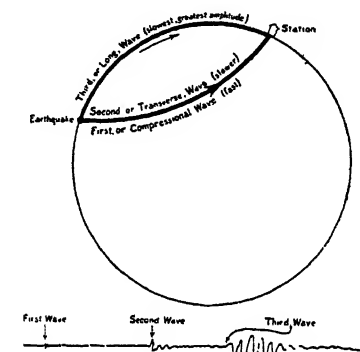
A, B, C, D register the horizontal movements; E records vertical movements of the earth's crust

the refraction, reflection, and retardation or acceleration, they produce in transmitting artificial earth tremors. Small earthquakes are produced by exploding charges of dynamite, and the times of arrival of the resulting waves are then noted at a number of

portable seismograph stations. See GEOPHYSICS; SEISMOGRAPH; SEISMOLOGY.

SEISMOGRAPH, an instrument for measuring and recording the magnitude and direction of minute vibrations of the earth's crust, as in earthquakes and subterranean explosions. The seismograph is, essentially, a heavy mass flexibly supported so that it will remain in position due to its inertia, while its supports oscillate with the earth. There are two types, one indicating horizontal and the other vertical motion. See also EARTHQUAKES; SEISMOLOGY; GEOPHYSICS.

SEISMOLOGY, the geological science which deals with the origin and nature of EARTHQUAKES, and their accompanying phenomena. Earthquakes are caused either by rock movements which take place beneath the earth's surface, called tectonic earthquakes, or by volcanic eruptions, called volcanic earthquakes.



COURTESY THE SCIENTIFIC MONTHLY

PATH OF EARTHQUAKE WAVES THROUGH THE EARTH, RECORDED AT A GIVEN STATION.

The form of record is shown below

These disturbances generate series of vibrations which travel outwards in all directions with speeds from 4 to 8 miles per second. Seismographs, through the inertia of heavy weights which do not move when the ground trembles, record these waves in magnified diagrams on smoked paper or photographic films. Since earth waves are reflected and refracted by various geological formations, which also influence their speed of travel, much information concerning the constitution of the interior of the earth has been gleaned from seismological records. The correlation of records from several stations permits also the deduction of the point of origin of a distant disturbance. Seismology is also concerned with other phases of earthquake phenomena, such as ground displacement, earth fissures, generation of air waves (noises), and sea waves, and the destruction of buildings.

The effect of various geological formations on artificially produced earth waves is utilized practically for the investigation of underground geology, known as Seismic Prospecting, as described under GEOPHYSICS. See also GEOLOGY; SEISMOGRAPH; VOLCANISM.

BIBLIOGRAPHY.—Chas. Davison, *A Manual of Seismology*, 1921.

SEKANI, a group of North American Indian tribes of the northern division of the Athapaskan linguistic stock occupying the valleys of the upper Peace River and its branches and the western slope of the Rocky Mountains in British Columbia. Due largely to its nomadic life, this once large tribe has been separated into small unaffiliated groups. Among surrounding tribes they are considered warlike and are consequently much feared. They are nomadic hunters, each of the nine tribes laying claim to poorly defined hunting territories. Their houses are roughly constructed brush huts; their clothing is of mountain-goat or big-horn skins. Loosely organized into patrilineal bands and having no chiefs the oldest and most influential person in the band is the recognized authority.

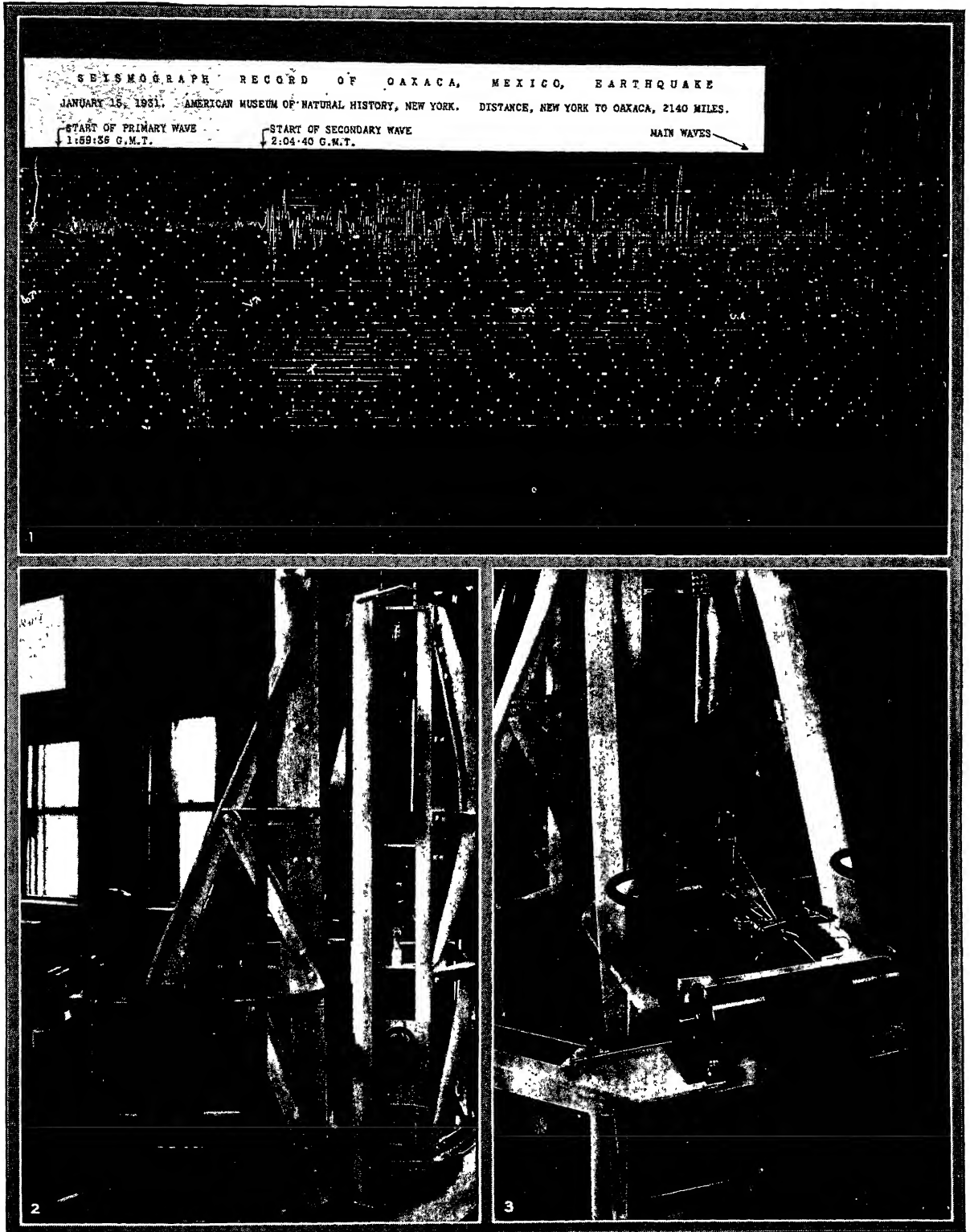
SELAGINELLA, a very large genus of plants allied to the ferns. There are about 700 species, nearly all natives of the tropics; some 15 occur in North America, chiefly in the southern states. They grow in damp places usually in forests, but a few are found in deserts. Most selaginellas are perennials with creeping or climbing much-branched stems which bear roots on the lower side and scalelike leaves on the upper; several species with erect or ascending stems are grown in greenhouses for their attractive foliage. See also RESURRECTION PLANT.

SELANGOR, one of the Federated Malay States occupying an area of 3,150 sq. mi. in the western part of the Malay Peninsula. It is administered by a native ruler under British protection. The chief rivers are the Klang and the Langat. At the mouth of the Klang is Port Swettenham, but Kuala Lumpur, the capital of Selangor and of the Federated Malay States, is the largest city, having a population of 100,000. The chief exports are rubber, copra, tin and tin ore, timber and hides. Pop. 1921, 401,009.

SELBY, an urban district in the West Riding of Yorkshire, England, lying upon a level plain at the left bank of the Ouse, about 175 mi. northwest of London. An industrial town, its chief antiquarian interest centers in the church of an abbey founded by William the Conqueror, 1069, and created a mitered abbey by Pope Alexander II. Although badly gutted in 1906, it still is one of the most beautiful monastic churches in England. Selby is the traditional birthplace of Henry I. It is situated in the heart of an agricultural district, and along its river are shops for building river craft. Pop. 1921, 9,984; 1931, 10,064.

SELDEN, GEORGE BALDWIN (1845-1922), American mechanical engineer and automobile inventor, was born at Rochester, N.Y., in 1845. He was graduated from Yale in 1869, and studied law under his father, until his interest turned to engineering. In 1875 he constructed an engine which used a mixture of laughing gas and kerosene for fuel. Although the engine was a failure, Selden became convinced from his experiments that an internal combustion engine of the compression type, using a liquid fuel, was practicable. In the face of widespread ridicule, he per-

SEISMOGRAPH



COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE SEISMOGRAPH AND ITS RECORD OF AN EARTHQUAKE

1. Record of the earthquake at Oaxaca, Mexico, Jan. 15, 1931, made at New York City, 2,140 miles away.
2. Seismograph at the American Museum of Natural History.
3. View of the recording mechanism of the seismograph.

severed until 1879, when he filed a patent application for the first patent for a gasoline motor-propelled vehicle. After many years of litigation he was granted the patent in 1896, and until 1911 American automobile manufacturers, excepting Ford, produced their machines under the Selden license. The invention consisted in the basic method of applying the power of an internal combustion engine to motor vehicle propulsion. Selden died at Rochester, Jan. 17, 1922.

SELECTION BOARD, U.S. NAVY, a board authorized by Congress after the so-called Plucking Board was abolished in 1915, and in existence since Aug. 29, 1916. All promotions in the Navy to the grades of commander, captain and rear admiral are made by a board of naval officers. Their recommendations require final approval by the President. The board consists of nine rear admirals on the active list of the Navy, and is appointed by the Secretary of the Navy, and meets at least once each year. The number of vacancies in the various grades is furnished the board. Officers eligible for promotion have certain rights as to presenting to the board matters pertaining to their individual cases. Certain service in grade and certain sea duty qualifications are required. The board must remain in session at least ten days. It must examine the complete mental, moral and physical record of each candidate as shown by official papers. It must make a report in writing that in the opinion of at least six members of the board the officers recommended are the best fitted of all those under consideration to assume the duties of the next higher grade. Certain rules as to the promotion of officers performing engineering duty only exist and officers of the various staff corps of the Navy are promoted to the rank of rear admiral, captain and commander, in their various corps by selection boards composed of officers in their respective corps. R. E. C.

SELECTIVE CONTROL, a method by which remote control and supervision of an electrical power system is obtained by a load dispatcher in one station. By small switches on a dummy board and a few control wires, remote generators are started, switches closed, and the like, the operations being indicated to the dispatcher by signals. Common types are the *step-by-step*, the *selector* and the *carrier-frequency* systems.

BIBLIOGRAPHY.—C. Lichtenberg and F. Zogbaum, *Remote Operating Supervision and Control of Electric Power Stations*, World Engineering Congress, Tokio, 1929.

SELECTIVE SERVICE, a phrase which came into use during the World War to identify the system under which the military and naval establishments of the United States, insofar as personnel was concerned, were transformed from a peace time basis to a war footing and maintained on a war footing during the period of American participation in that war. The principles underlying the system recognized the right of the government to command the man-power of the country to defend it; recognized the necessity for mobilizing and maintaining the industrial as well as the military man-power of the country; and recognized

the right of the government to determine whether an individual should be called to render his national service in the Army or Navy, or should render that service as an individual engaged in one of the industries of the country essential to the successful prosecution of the war. Selection for military as distinguished from industrial service was a civil and not a military function—a function performed in the first instance locally, by representatives of the people subject to selection. The system required all to render national service—to work or fight; it did, in fact, mobilize effectively the man-power of the country for national service during the war.

The statutory basis for the application of the Selective Service system is found in the Act of Congress, approved by the President on May 18, 1917, which, after its adoption and in the course of its administration, came to be known as The Selective Service Act. *See also* CONSCRIPTION; DRAFT; ENLISTMENT. E. A. K.

SELENE or SELENA, in Greek mythology, goddess of the moon. She was the daughter of **HYPERION** and **Theia**, and sister of **Eos** and **HELIOS**. The Romans called her **Luna**. She is represented as driving a chariot drawn by a team of horses, cows or oxen.

SELENITE, the crystalline, transparent, and colorless form of **GYPsum**. It usually occurs in distinct crystals, or broad sheets, and ordinarily is flexible. That from the famous Montmartre quarries, near Paris, France, is brittle. Selenite crystallizes in the **MONOCLINIC SYSTEM**, and twin crystals, shaped like arrow heads, or swallow's tails, are quite frequent. These may be distributed through beds of gypsum or of **LIMESTONE**. Selenite is a hydrous calcium sulphate.

The commercial source of gypsum is from massive deposits. Where selenite is obtained, it is usually mixed with massive gypsum, and goes through the same treatment to serve the same uses.

In the United States, selenite is found in New York, Maryland, Ohio, Tennessee, Utah, and in the Cretaceous clays of the western states.

SELENIUM, a chemical element belonging to the same group as, and strongly resembling, sulphur in its properties, was discovered by Berzelius in 1817. Its chemical symbol is **Se**, its atomic weight 79.2; it is generally obtained from the residues of worked-up sulphides. In most of its compounds, it behaves like sulphur, and similarly appears in many allotropic forms in the pure state. It is used largely as a decolorizer for glass, and for a while promised extensive application because of its remarkable property of increasing its electrical conductivity when exposed to light; but the selenium cells with which "light can be heard" have now been replaced by the much more sensitive photo-electric cells containing alkali metals.

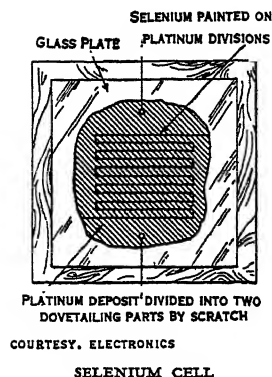
SELENIUM CELL. The electrical RESISTANCE of **SELENIUM** decreases appreciably under the action of **LIGHT**. In the selenium cell, electrical connections are made to a surface coated with metallic selenium. In use, a small electric current is made to pass through

the cell. When the cell is illuminated, this current increases, and the amount of the increase may be used to measure the intensity of the illumination. The selectivity of the cell for **COLORS** is quite different from that of the eye. Another disadvantage is the

marked fatigue effect it shows; when the light is cut off, the resistance recovers only slowly, and the time-lag varies with the intensity of the illumination to which the cell has been subjected.

The change in the electric current with changes in illumination may be amplified and used to operate various devices through relays, e.g., lamps may be turned on at dark and off at dawn.

R. T. C.



SELENOS. See SILENUS.

SELEUCIDS, the kings who acquired the eastern section of the Empire of Alexander the Great. The founder, Seleucus, had been one of Alexander's generals, and following the latter's death in 323 B.C. secured the east by war and agreements with the other generals. The Seleucid Empire extended generally from the Oxus to Syria, sometimes including Armenia. Bitter wars were fought with the Egyptian Ptolemies for Palestine. The Empire spread a thin but impermanent layer of classical civilization over the east. Internal dissolution and ruinous foreign wars made the Empire an easy prey for Rome during the latter years of the republic.

SELF, the subject of activity as distinguished from the object acting upon it. Self, like personality, is an achievement. The infant is not conscious of himself as a self. He does not distinguish between self and some particular part of the body. Thus he may locate self in his big toe, or any other part of his anatomy that may happen temporarily to attract his attention. Wherever sensation is most pronounced, there will the self be located. It is only gradually that he begins to distinguish between himself as different from the object of perception or from other selves. With the growth of experience and continuity of memory this differentiation takes place.

Psychologically, self is located in the object of interest. Whatever interest is dominant at a given time will determine to a large extent the character of the self to be realized. The individual has as many selves as he has interests. The business man at the office may be quite a different type of self from what he is at home. One puts on different selves according to the relations into which one enters. It was **WILLIAM JAMES** who pointed out the social self, the material self and the moral self that all possess. Yet running throughout these different selves there is for the most part a sense of personal identity and continuity of the memory stream. See **PERSONALITY**.

SELF-DEFENSE, defense of one's self or his family, family home, or possession of property against violent attack. It justifies employment of force reasonably sufficient to ward off the attack. In case of attack with a dangerous weapon, self-defense may go even to the extent of killing, if under the circumstances that appears reasonably to be necessary. Self-defense should be distinguished from self-redress. One who has suffered a legal wrong is permitted only in a few exceptional cases to redress the wrong forcibly by his own action.

SELF-DETERMINATION, a principle in international relations which demands for all nations or self-conscious political entities, the right to manage their own affairs as the citizens of each nation see fit, free from outside control or interference. The antithesis of this principle is the tenet of **IMPERIALISM** which assumes the right of the stronger and so-called more advanced states to impose their rule upon weaker or backward political entities. The American Revolution more or less typified the conflict between these two principles. The demands for dominion status (see **DOMINIONS**) on the part of the overseas possessions of the British Empire are still further manifestations of the vitality of the dogma. Woodrow Wilson in his famous **FOURTEEN POINTS** paid tribute to the doctrine. And the **TREATY OF VERSAILLES**, if it has any basic principle other than to the victor belong the spoils, rests upon the right of self-determination.

S. C. W.

SELF-HEAL (*Prunella vulgaris*), a small perennial herb of the mint family, called also heal-all and carpenter-weed. It is native to moist soils very widely throughout the world. The slender, erect or ascending, slightly branched stem bears oblong leaves and violet, purple or white flowers in dense terminal clusters. By the old herbalists the plant was highly commended for its supposed healing properties.

SELFRIDGE, HARRY GORDON (1864-), American merchant, born at Ripon, Wis., Jan. 11, 1864. He received a public school education, and, in 1879, entered the employ of Field, Leiter & Co., Chicago, Ill., in which he became a partner of Marshall Field. He sold his interest in 1904 and established H. G. Selfridge & Co., which he sold the same year to Carson, Pirie, Scott & Co. In 1906, he went to London, and three years later opened a store which offered every variety of merchandise under one roof, after the model of Marshall Field & Co. The store grew into one of the most valuable department-store properties in the world, and its plan was copied by competitors in Paris and Berlin. In 1918, he published *The Romance of Commerce*.

SELIGMAN, an American Jewish family of prominent merchants, bankers and philanthropists which originated in the town of Baiersdorf, Bavaria, and consisted of the eight sons of David Seligman. Joseph, the oldest, was born at Baiersdorf in 1819. He emigrated to the United States in 1837. With the aid of three of his brothers, William, James and Jesse, he established himself in the clothing business, be-

came prominent in the mercantile world, and in 1857 entered the banking business. For many years the firm of J. and W. Seligman, with offices in New York, London, Paris and Frankfort-on-Main, were financial agents for the United States Navy and the United States Department of State. One of the chief merits of the firm was the financing of the Union during the Civil War through the securing of European financial aid. Joseph Seligman founded the Hebrew Orphan Asylum in 1859, and was co-founder and president of the Society for Ethical Culture in New York until his death at New Orleans in 1880. Jesse was born at Baersdorf in 1827 and died at Coronado Beach, Cal., in 1894. He assisted his brother in the establishment of the Hebrew Orphan Asylum and played a prominent part in the financing of the Panama Canal.

A. SH.

SELINUS, the most important Greek colony of Sicily, now Castel Vetrano. Founded in 628 B.C., it was located on the southwest coast at the mouth of the Selinus River. At first a rival of Segesta, it later became an object of Carthaginian attack. The city was destroyed by Hannibal during the Second Punic War with Sicily in 409 B.C. Unlike Himera, it was later rebuilt.

SELJUKS, a Turkish ruling dynasty originating in the 10th century from among the Ghuzz tribes of Transoxiana. At the death of Malik Shah in the 11th century, various branches of the Seljuk dynasty established themselves in Kerman, Iraq and Syria and continued to rule throughout the 12th and 13th centuries. The Seljuks succeeded the Arabian Caliphate and themselves laid the foundations for the Turkish empire under the Ottoman dynasty.

SELKIRK, THOMAS DOUGLAS, fifth Earl of (1771-1820), philanthropist and colonizer of British North America, was born in Kirkcudbrightshire, Scotland. He was educated at the University of Edinburgh, and became interested in directing the emigration of impecunious Highlanders to Canada and in diverting thereto the stream of British emigration into the United States. Attracted by ALEXANDER MACKENZIE's accounts to the Red River region as a site for settlement, he was compelled by the British government to choose lands not so remote; in 1803 he despatched 800 colonists to Prince Edward Island, and himself supervised the beginnings of a successful settlement. Selkirk made other purchases of virgin lands, but was prevented by the Continental wars from immediately carrying forward his plans for settlement. Convinced of the importance to British dominion in North America of a western settlement, when the Hudson's Bay Company refused to permit such a settlement for fear of its effect on the fur trade Selkirk secured a controlling interest in the company and secured authorization of the Red River Settlement, established in 1812. Selkirk hastened to the Settlement in 1816 at news of hostilities between his colonists and the Northwest Company, and overawed the fur traders with hired soldiers; subsequently he was mulcted for heavy damages by the Northwest

Company. Broken in health, he left Canada in 1818 and shortly after died in France.

SELKIRK, a royal burgh and county town of Selkirkshire, Scotland, lying above Ettrick Water, about 39 mi. southeast of Edinburgh. Originally clustered about a Culdee Church, in the 12th century, it acquired a castle and abbey. During the border wars it suffered severely, and is particularly associated with the disastrous Battle of Flodden. Tweed weaving now flourishes in the well-built, modern town. Pop. 1921, 5,775; 1931, 5,667.

SELKIRK MOUNTAINS, a range in the southeastern part of British Columbia, extending northward from the United States boundary to the great loop of the Columbia River. They follow the general trend of the Rockies just east of them and are flanked by the Gold Range on the west. The Selkirks are not quite so high as the Rockies but are quite as Alpine in appearance with fairly extensive glaciers and dense primeval forests. Their loftiest summits include the pyramidal peak of Sir Donald towering 10,645 ft.; Mt. Dawson, 10,800 ft., and Mt. Bonney, 10,625 ft. The heavy rainfall of the region clothes the lower slopes and valleys with an almost tropical rankness of forest which is splendid to look upon. Along the valleys the evergreen have a blackish hue which graduates to a paler green on the slopes and ends with the purplish cliffs of quartzite at the summits.

This range is completely surrounded by water, making it an island 300 mi. long, 80 mi. wide and almost 2 mi. high. The Columbia with its tributary the Kootenay encircles it on all sides except for a space on the east where a canal is cut to complete the water girdle. In the Big Bend country to the north rich gold deposits have been found. The greatest natural curiosity in the mountains is Nakimu Caves, a series of magnificent caverns in the Glacier Park reserve.

SELLING, PSYCHOLOGY OF, the application of psychological principles to selling technique. Selling is an art rather than a science. Just as it helps the sculptor to know something of anatomy, so may it help the salesman to know something about psychology. The good salesman utilizes the principles of psychology even though he may not be aware of this fact.

The same principles that apply to effective advertising are valuable in ordinary salesmanship. Advertising is in fact a part of selling. In the first place it is necessary to catch the attention of the prospective buyer. It is the novel or the unusual thing that attracts attention. Clever displays are also a large factor in accomplishing this result. Attractive window designs, clever advertising posters and the like are all ways of attracting attention. It is important that attention should be captured without creating a jarring effect, however, for this is apt to lead to a loss of interest. And to effect a sale, interest must be maintained throughout the buying point.

The more interests that can be appealed to, the better. Cleanliness, comfort and safety are all inter-

ests that make an appeal. In some cases vanity is a very important consideration. In appealing to such an interest it is well not to overdo the matter; when it becomes too obvious that this is the motive back of the appeal, flattery ceases to have the right effect. If interest can be held for a sufficient length of time it helps to stimulate desire; and vice versa, if desire can be whetted to some extent it frequently arouses interest. When both interest and desire reach the saturation point it is time for the decision to be made; the psychological moment. To try to force decision before this point is reached may be disastrous, and the same is true of such an attempt when interest is on the wane. The good salesman is one who can lead the customer on without the latter's knowledge. He knows when the psychological moment has come and closes the deal accordingly. Often suggestion and the use of analogy are important factors in the transaction. Generally speaking, positive suggestions are better than negative ones, and analogies, when used, should make a personal appeal in order to be effective. See also SALESMANSHIP.

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SELMA, a city of south central Alabama and county seat of Dallas Co., on the Alabama River, 50 mi. west of Montgomery. Transportation facilities include the Louisville and Nashville, the Southern (the latter maintaining division headquarters at Selma), and the Western of Alabama railways. There is a United States emergency landing-field, and river navigation is possible throughout the year. Selma is located in the "cotton belt," and its principal crops are cotton and corn. It is not only a manufacturing city, specializing in iron and textile industries, but is also an important creamery center of the south. In 1929 the manufactures reached approximately \$7,000,000; the retail trade amounted to \$8,800,846. The Confederate Arsenal and Ordnance Works were established in Selma 1862, and the gunboats forming Buchanan's fleet at Ft. Morgan were built here. The city was captured by Federal troops under Gen. James Wilson, April 2, 1865. Selma claims two centuries of existence, since the locality appears on d'Anville's map of 1732 as "Écor Bienville." It was subsequently, about 1809-10, known as "High Soapstone Bluff," later "Moore's Bluff," and finally, in 1820, was incorporated as "Selma," a name chosen from MacPherson's "Poems of Ossian." The city charter dates from 1830. Pop. 1920, 15,589; 1930, 18,012.

SELMA UNIVERSITY, at Selma, Ala., founded in 1878 for the education of Negroes, was originally known as the Alabama Baptist Normal and Theological School. In 1880 it was adopted by the American Baptist Home Mission Society and has since been supported by that organization. The university maintains primary, secondary and college courses, and gives training in theological, commercial and industrial subjects. The student enrollment for the academic year 1926-27 was 451, of which the college en-

rollment was 26. The faculty of seven was headed by Pres. R. T. Pollard.

SELVAS, called also *silvas*, in South America plains clothed in primeval forest, especially vast densely wooded tracts in the Amazon basin of Brazil. Heavy rainfall with tropical heat permits the forests to remain evergreen, supporting a profuse tangle of diverse plant forms which make the vegetation of the *selvas* the densest on the globe.

SEMANTICS, the branch of **LINGUISTICS** concerned with the meaning of words, the evolution of their significations, and the history of such developments, representing together with **SYNTAX**, the psychological side of linguistic study. Broadly speaking, words tend to pass from general to specific senses. Beginning with the very vague signification of the **BASE**, the use either of a **DETERMINANT** or of an **INFLECTION** is in itself a specialization, this process being continued in each succeeding step. Thus the **INDO-EUROPEAN** base **dheues-*, "breath, breathe," has such descendants as Greek *theós*, "god" (as a "spirit"), Middle High German *ge-twās*, "ghost," ("spirit" in another sense), Gothic *dius*, "wild beast," German *tier*, "animal." In Anglo-Saxon and archaic English, the equivalent "deer" meant merely "animal" (cf. "mice, and rats, and such small deer" in *King Lear*); but since a certain animal was *the* animal of the hunt, it came to be called simply "deer." Words may even lose all sense of their early meanings. Thus English "pen," like its equivalents, French *plume*, German *feder*, originally meant "feather," but has come to denote only a certain instrument for writing, so that one speaks, without any feeling of absurdity, of a "steel-pen" or a "fountain-pen," though a feather itself can be neither steel nor a fountain.

The reverse development, from specific to general, is relatively rare, and is mostly due either to some evolution in the history of civilization, or to analogical extension. Thus Latin *pecus* meant "cattle"; but since cattle were the chief form of property in the early Roman period, the cognate *pecunia*, "collectivity of cattle," came to mean "property, wealth, money," so that *pecuniarius*, English "pecuniary" denotes only "financial, monetary," the implication of "cattle" having entirely vanished. Again, "crown" means properly an ornament worn on the head by royalty and high nobility, but has been extended analogically to denote the topmost point or acme, as "crown of virtue," "a virtuous woman is a crown to her husband" (Proverbs 12: 4), "crown of a hat, of a road, of a tooth," or a coin marked with a crown (the original meaning here so lost that one speaks of "half-a-crown"); or the names of well-known historical or literary characters are extended to persons supposed to resemble them, as "a Galahad," "a Hercules," "a Machiavelli," "a Judas," "a Messalina," etc.

Words are, further, specialized in technical senses, as operation in "operation of the Holy Ghost," "surgical operation," "military operation," "operation of a machine," this being a main reason for creation of "learned" or "alien" words (see **LOAN-WORD**). Words

may also be displaced, and then replaced by others, for various reasons, e.g., because they are regarded as vulgar (*see* EUPHEMISM), or a word may, in the course of its evolution, suffer such alteration as to become obscure, in which case it tends to disappear and to be replaced by another, and often unrelated, term. Thus Latin *avis*, "bird," survives in Spanish as *ave*, but since in French it would become **oi*, it has there been replaced by what was originally a diminutive, Latin *avicellus*, *auccellus*, whence Italian *uccello*, French *oiseau*. Again, a word originally confined to the lower classes, or used humorously, may rise to the higher classes and replace words primarily far more dignified. Thus Latin *caput* survived as *chef* in French only in specialized meanings, and has been replaced by *tête*, Old French *teste*, from Latin *testa*, "pot, jar."

The meaning of words changes, further, either for the better ("melioration" or for the worse "pejoration"). Generally speaking, ethical concepts tend toward pejoration; meanings based on social changes toward pejoration and melioration about equally, examples of the former being English "silly," which, like its German counterpart *selig*, earlier meant "blessed, happy" (cf. Shakespeare's *silly sheep* "happy, innocent sheep"); of the latter, Latin *dux*, "leader of any kind," then leader of an army, then a high noble, whence French *duc*, English *duke*, etc.

Semantics is, finally, a factor in creating "popular etymologies" (cf. ANALOGY; ETYMOLOGY), as English "demijohn" from French *demijeanne* (literally, "half of John or Jeanne") from Damghan, the name of a town in Persia where such vessels were made; Beaver Street (in New York City, etc.) from the English pronunciation of Belvoir (French, "beautiful view") Castle in England. L. H. G.

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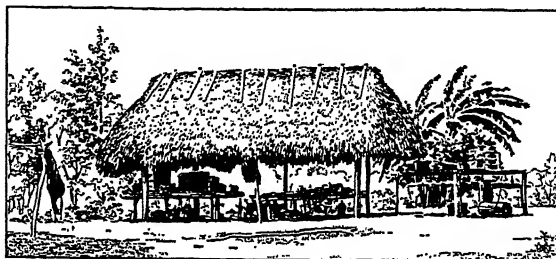
SEMAPHORE. *See* RAILROAD SIGNALING AND INTERLOCKING.

SEMARANG, also Samarang, the third largest port of Java, Dutch East Indies. It is the capital of the residency of Semarang and is situated near the mouth of the river of the same name, 240 mi. east of Batavia. The city is well-built and is one of the liveliest commercial centers of Dutch India. The surrounding country produces tobacco, coffee, pepper, indigo, sugar and rice. Pop. 150,000.

SEMBRICH, MARCELLA (1858-), Polish singer, was born at Wisniwcyk, Feb. 18, 1858. As a child she studied the piano and violin. In 1875 she studied singing under Rokitansky, and two years later made her operatic début at Athens. Her first appearance at New York was as Lucia in 1888, and she was a leading member of the Metropolitan Opera company during 1898-1909. She retired from the operatic stage in 1910, to sing in concert and to teach. In 1924 she was appointed head of the vocal department of the Curtis Institute, Philadelphia, Pa.

SEMELE, in Greek mythology, daughter of CADMUS and Harmonia, sister of Ino, Agave and Polydorus. Semele was destroyed by the thunderbolt which Zeus carried when he visited her. The god saved her unborn son, Dionysus (*see* BACCHUS), who later led his mother out of Hades to Olympus, where she became immortal under the name of Thyone.

SEMINOLE, a large tribe of North American Indians speaking a dialect of the Muskogean linguistic stock. They formerly lived in northern Florida and southern Georgia. Following the last Seminole war, the majority were exiled to Oklahoma by the United States Government. A small band escaped into the



SHELTER OF THE SEMINOLE INDIANS

fastnesses of the Everglades swamp where some members now live. The Seminole belong to the southeastern culture area. Their dwellings are palmetto thatched shelters with no sides and they sleep on log platforms or tables. They were chiefly an agricultural people. Their dug-out canoes made from cypress logs were peculiarly shaped to permit passage through the dense swamp grasses.

SEMINOLE, a city in Seminole Co., eastern central Oklahoma. It is situated 46 mi. southeast of Oklahoma City, and is served by the Chicago, Rock Island and Pacific Railroad. Cotton is the chief crop of the district. Nearby are oil wells. One of the largest gasoline refineries in the world is located here, and cotton ginning is an important industry. The retail trade in 1929 amounted to \$14,224,124. Pop. 1920, 854; 1930, 11,459.

SEMINOLE WARS, two protracted conflicts between the United States and the Seminole Indians in Florida. In 1817 the Seminoles, augmented by fugitive slaves and renegade Spaniards, began a series of depredations upon American settlements in Georgia. Gen. Jackson in 1818 invaded their territory, disregarding the Spanish sovereignty over Florida, pursued them into the Everglades, destroyed their principle towns, and arbitrarily executed two British subjects, Arbuthnot and Ambrister, whom he charged with instigating the trouble. These events were materially instrumental in persuading Spain to sell Florida to the United States. (*See* SPAIN, TREATY WITH, 1819.) In 1832 American commissioners arranged a treaty with the Seminoles, persuading them to move west of the Mississippi. The younger braves, led by Osceola, repudiated the treaty and killed an offensive Indian Agent. Beginning with the massacre of an entire expedition, Maj. Dade and 100 troops, on Dec.

28, 1835, Osceola sustained the Second Seminole War until 1837, when he was treacherously seized while holding a conference under a flag of truce. The war, which was the most desperate and costly Indian war in United States history, continued until



SEMINOLE INDIAN AND HIS SQUAW

1842. Fifteen hundred lives, most of them lost through the ravages of disease, and almost \$20,000,000 was the price which our Government paid to remove the Seminoles to lands west of the Mississippi.

SEMIPALATINSK, a city of the Kazak Autonomous Republic, part of the R.S.F.S.R., situated in southwest Asiatic Russia on the Irtysh River 686 ft. above sea level. Though the river is frozen from early December until late April, steamers plying to Lake Gaisan and Omsk collect tallow, cattle and wool from the Kirghiz tribes for shipment on the railway which runs from Semipalatinsk in Novo-Sibirsk. Local industries are represented by flour mills, breweries and leather goods factories. Pop. 1926, 56,889.

SEMITIC, a **LINGUISTIC FAMILY** comprising the languages spoken in Mesopotamia, Syria, Palestine, Arabia and Abyssinia, their designation being derived from the Hebrew proper name Shem (Genesis 10). Although each of them has its own individual characteristics, they are all akin in structure and vocabulary, a phenomenon explained by the assumption that they are the offspring of a common speech called "Proto-Semitic." Their geographic distribution is as follows:

Proto-Semitic

East	North	West	South
ACCADIAN	ARAMAIC	CANAANITE	ARABIC
Babylonian	Nabataean	Hebrew	Sabaeen
Assyrian	Palmyrene	Moabite	Minæan
	Syriac	Phoenician	Mahri
	Samaritan		Ethiopic
	Mandaean		Tigré
			Tigrîña
			Amharic

The outstanding characteristics of the Semitic languages are the prevalence of sonants over semisonants, and the large number of gutturals, velars, sibilants and dentals. Every word, excepting pronouns and particles, has as its **BASE** a consonantal root which in itself conveys only an abstract idea without reference to either time or state. The majority of roots are trilateral, though the proto-Semitic speech must have had more biconsonantal roots than are now exhibited by the various dialects.

The various parts of speech are formed from the abstract root plus any or all of the following: modification of the vowels; doubling of one radical, generally the second; insertion of a sonant or semisonant; and addition of preformatives and affirmatives. The verb does not denote a specific tense, but expresses only a state of action, i.e., complete or incomplete (cf. **АСПЕКТ**). There are two genders, masculine and feminine; three numbers, singular, dual and plural; and three cases, nominative, genitive and accusative, and the pronoun is also used as an enclitic to the noun, verb and preposition. Actual compounds are few; but extensive use is made, instead, of the construct case.

I. M.

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SEMITONE, in music, a small interval of variable magnitude. In **JUST INTONATION**, or pure tuning, it is called a chromatic semitone, or augmented prime or unison, in the form C—C♯, E—E♯, and so on, being called a diatonic semitone, or minor second, in the form C—D♭, E—F, and so on. In terms of vibration frequency, the chromatic semitone is 25:24; that is C♯ : C :: 25:24. The diatonic semitone, on the other hand, is expressed by the ratio 16:15; that is, D♭ : C :: 16:15. The diatonic is therefore a larger interval than the chromatic semitone. In equal **TEMPERAMENT** there is no distinction between the chromatic and diatonic semitone, both being expressed by the ratio $\sqrt[12]{2} : 1$.

SEMMELWEISS, IGNAZ PHILIPP (1818-1865), Hungarian physician, was born at Buda on July 1, 1818. He was educated at the universities of Pest and Vienna, and after graduating as an M.D. from the latter university in 1844, he was appointed assistant professor in the maternity department. The morality rate in this ward was 9.92%, which Semmelweiss reduced to 3.8% by insisting on the hands being washed in calcium chloride solution in connection with pregnancy and the conduct of labor. Semmelweiss is the true pioneer of antiseptics in obstetrics, and while Holmes antedated him in some details by five years, he recognized puerperal fever as a blood poisoning or septicemia. He met with considerable opposition and suddenly deserted his post and went to Budapest, there becoming professor of obstetrics at the university and publishing his great work *The Cause, Concept and Prophylaxis of Puerperal Fever*. He

died on Aug. 17, 1865, from an infected right hand, due to the causes he had been combating. M.F.

SEMMES, RAPHAEL (1809-77), Confederate naval officer, was born in Charles County, Md., Sept. 27, 1809, and at seventeen entered the U.S. Navy. He studied law, however, and resigned in 1834 to practice. He took part in the Mexican war and served in several battles, remaining in the U.S. Army service for a time. He commanded in the navy, serving on the Lighthouse Board at Washington in 1861, and resigned at the outbreak of the Civil War to serve in the Confederate Navy, in which he commanded the Confederate raider *Sumter* and finally the ironclad *Alabama* which was sunk by the *Kearsarge* in a battle off Cherbourg, France, on June 19, 1864. He and the crew were rescued by an English ship and Semmes returned to duty with the rank of rear-admiral. After Richmond, in April, 1865, was captured, he joined General Johnston's army. He was the author of many interesting books on his experiences in the Mexican and Civil Wars. Died at Mobile, Ala., Aug. 30, 1877.

SEMOLINA, the middlings of durum wheat, a very hard spring wheat of high protein content, first grown in southern Russia, but now also grown in North Dakota and adjacent regions. *See also* WHEAT; PASTES, ALIMENTARY.

SEMPACH, BATTLE OF. *See* SWITZERLAND, HISTORY OF.

SENATE, the name frequently used to denote the upper chamber of a bicameral legislature. The Senate of the United States is the so-called upper house of the American Congress. It is composed of 96 members, two from each state, who are chosen for terms of six years by the popular vote of the citizens of their respective states. Each Senator must be at least 30 years of age, nine years a citizen (*see* CITIZENSHIP) of the United States and an inhabitant of the state from which he is chosen. In addition to being a coordinate legislative body with the HOUSE OF REPRESENTATIVES save only that all bills for raising revenue must originate in the House, the Senate has vested in it certain quasi-executive functions, viz., the approval of all executive appointments to the superior offices and the ratification of all TREATIES. In ancient Rome the Senate was a body of elders which expressed its opinions on public questions (but without the force of law unless ratified by the assembly), sent and received ambassadors, ratified certain public measures, nominated DICTATORS, directed public finance, imposed certain taxes, set religious holidays, supervised religious activities, organized conquered lands and handed down matters to the assemblies for vote.

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SENECA, LUCIUS ANNAEUS (c. 4 B.C.-A.D. 65), Roman philosopher, son of the noted rhetorician, Annaeus Seneca, was born at Corduba (Cordova) about 4 B.C. At an early age he was brought to Rome, where he studied rhetoric and the philosophy of the Pythagorean and Stoic schools. He entered public life and had attained prominence when in 41 A.D. he was banished to Corsica on the charge of

having a love affair with Julia, daughter of Germanicus. Eight years later Seneca was recalled to Rome by Claudius and, through Agrippina's influence, was raised to the praetorship and appointed tutor to her son, Nero. For several years after the latter mounted the throne in 54, Seneca maintained influence over him. But in 62, sensing that his enormous wealth was coveted by Nero, and that his enemies at court were becoming increasingly powerful, Seneca retired to seclusion in Spain. His retirement was of no avail; in 65 he was accused of taking part in Piso's conspiracy and was ordered by Nero to commit suicide. This he did by opening his veins, and when death did not come speedily he suffocated himself in a vapor bath, displaying throughout a truly Socratic composure.

Seneca was a very fertile and versatile writer. His writings are eloquent in style and rich in aphorisms, although marred by an excessive use of rhetorical ornamentation. Essentially Stoic in spirit, they reveal so elevated a morality that the early Christians claimed their author as one of themselves. He was not an unusually profound thinker but possessed wide knowledge and sympathetic understanding.

Among his numerous literary productions were three epistles called *De consolazione*, 20 books of epis-



SEPULCHER OF SENECA ON THE APPIAN WAY

cles, mostly concerning philosophical problems, to his friend Lucilius, seven books on natural science, the twelve so-called dialogues, consisting of moral essays; and ten tragedies ascribed to him. These plays while intended to be read rather than staged, nevertheless had a considerable influence on Elizabethan tragedy. He died at his villa near Rome, 65 A.D.

SENECA, a prominent and influential tribe of the Iroquois Confederacy. When first encountered they were occupying that section of western New York which lies between Seneca Lake and the Genesee River and held their council fire at Tsonontowan near the present city of Naples in Ontario county. They were the leading tribe in the destruction of the Huron in 1648-49 and also in the defeat and subjugation of the Neutrals in 1651 and of the Erie in 1656. By 1657 the Seneca had incorporated the survivors of 11 conquered tribes into their body politic and had spread westward to Lake Erie and southward to the Alleghenies. They sided with the French in the French and Indian War and with the English in the Revolution. Several reservations have been allotted to them in western New York State.

SENECA FALLS, an industrial village in Seneca Co., western New York, situated on the Seneca River, which connects Lake Seneca with Lake Cayuga, 40 mi. southwest of Syracuse. Two railroads and the Cayuga-Seneca Branch of the State Barge Canal afford transportation. Seneca Falls is in a good farming region. Its manufactures include pumps, machine tools, men's hose, woolen goods and wood novelties. The falls in the river supply hydro-electric power. The village is in the charming Finger Lake region, surrounded by summer resorts. Seneca Falls was founded in 1790; incorporated in 1831. Pop. 1920, 6,389; 1930, 6,443.

SENECA FALLS, a cascade on the Seneca River, New York. The river, which is an outlet of Seneca Lake, one of the Finger Lakes group, has a fall of 60 ft. in 14 mi., and 50 ft. of this occurs at Seneca Falls.

SENECA SNAKEROOT (*Polygala Senega*), a small smooth perennial of the MILKWORT family sometimes called mountain flax. It is found in rocky woods from New Brunswick to Alberta and south-



COURTESY U.S. DEPT. OF AGRICULTURE

SENECA SNAKEROOT
Polygala Senega

ward to North Carolina and Arkansas. The usually erect stems, 6 to 18 in. high, rising from woody rootstocks, bear lance-shaped leaves and small greenish-white flowers crowded in terminal spikes. The dried

rootstocks, formerly reputed as a cure for snake bites, are used in medicine as a diuretic and expectorant.

SENECIO, an immense genus of flowering plants of the composite family. It is one of the largest of plant genera, comprising upward of 1,200 species found in all parts of the world, a number of which are cultivated for their ornamental flowers or foliage. Nearly 200 species are found in North America, most numerous in the Rocky Mountain region. They are chiefly annual and perennial herbs but include many shrubs, some of climbing habit, and even trees, bearing solitary or clustered variously colored flower-heads. Among the cultivated species are various ragworts, groundsels and the cinerarias of the florists. Some of the climbing species, as *S. macroglossus* and *S. mikanioides*, resemble ivy. Many African species are showy flowering shrubs and *S. Johnstoni* is a remarkable tree of Kilimandjaro. See also CINERARIA; GERMAN IVY; GROUNDSEL; RAGWORT.

SENEFELDER, ALOYS (1771-1834), Bohemian printer and inventor of the process of lithography, was born at Prague. He eventually moved to Munich, and became an inspector of maps at the royal printing office. His discovery of the process of printing from stone, or lithography, was accidental. He announced his invention in 1826, and later was able to print in colors on various materials as linen. He is the author of articles and books on lithography, one of his best-known publications being *The Elements of Lithography*. Senefelder died Feb. 26, 1834, at Munich.

SENEGAL, a coastal colony of FRENCH WEST AFRICA, comprising the island of Goree and territory stretching inland to French Sudan. Area 74,112 sq. mi. Pop. 1,318,287, mostly Mohammedans. The soil is generally sandy, and primitive methods of tillage and rearing animals prevail. American cotton has been introduced in the south and Egyptian into the northern area subject to the inundations of the SENEGAL RIVER. The usual savanna products are met with, but the greatest concentration is upon peanuts, the export value of which reached \$35,000,000 in 1926. Some cotton, rice and palm kernels are produced. The colony is represented in the French Chamber by a deputy, and is administered by a lieutenant-governor and council. The capital is St. Louis; DAKAR, seat of the government-general, is the largest port.

SENEGAL, a river of west Africa, entering the Atlantic near the port of St. Louis after following a course of almost 1,000 mi.

From Morocco to the mouth of this river stretches an arid coast unbroken for 900 mi. by any waterway. The Senegal rises in the watershed between it and the Niger. Running northwest in a great curve it then continues southwest to the ocean. The mouth of the river becomes blocked with sand in the dry season from mid-April to mid-June, but during part of the year ships can ascend as far as Kayes, an important town connected with the Niger by means of a railroad to Bamako and Kulikoro, and joined with the port of Dakar by a railroad across Senegal Colony.

Two of the tributaries of the Senegal, the Baule

(Red River) and Bakoy (White), rise not far from the main branch of the Niger. A third, the Bafing (Black) River, with the Faleme, an important affluent on the left bank which enters the Senegal below Kayes, rises in the mountains of Futa Jallon, in 10° 28' N. lat. to 10° 5' W. long. The flat surface of the country through which these rivers flow results during the rainy season in the formation of lakes which facilitate communication by small boats and canoes.

In 1445 the mouth of the Senegal was entered by Dinas Diaz, the Portuguese navigator, but it was not until 1818 that Gaspard Mollien discovered the source.

SENENCOUR, ÉTIENNE PIVERT DE (1770-1846), French philosophical writer, was born in Paris in Nov. 1770. In 1789 he settled in Switzerland but returned to France again in 1803. He is best known for *Obermann*, 1804, letters of a semi-philosophical nature. Besides this he was the author of *Reveries sur la nature primitive de l'homme*, 1789, and *Observations sur la genie du Christianisme*, 1816. The former was a discourse on the nature of primitive man, and the latter consisted of reflections on Christianity. Senencour died at St. Cloud Jan. 10, 1846.

SENESCENCE. The normal span of life of most organisms includes a period terminating in death during which their physicochemical mechanism gradually slows down. This slackening in rate differs from that in hibernation or in other resting periods. The hibernating bear, or the chrysalis of an insect, has a rich supply of potential energy stored up as fat; the wintering plant has it stored as starch. In the spring the rejuvenating energy of the sun's rays and plenty of water speed up the machinery of life. Even though the old animal or plant may have plenty of stored food, the power to utilize these supplies is gone. Or its tissues may be starved by poor nutrition.

In early life, protoplasm is in a highly fluid, chemically active condition and the cells are as yet not highly specialized or differentiated; but at maturity, growth practically ceases, cells lose the fluid plasticity of their youth and become adapted for specialties such as muscular movement, transmission of stimuli and secretion. Then it is that they become stiffened with nitrogenous waste, which, owing to gradual drying, the blood cannot wash away. Arteries harden, joints stiffen; the aged person like the ancient tree becomes the easy prey of microscopic parasites. J. H. G.

SENIOR, NASSAU WILLIAM (1790-1864), English economist, was born at Compton, Berks, Sept. 26, 1790. He was professor of political economy at Oxford and a member of a royal commission to inquire into the poor law system. Senior drew up the report dealing with the evils existing under the administration and brought about the Poor Law Amendment Act of 1834. He wrote *An Outline of the Science of Political Economy*, published in 1836. His other writings dealt with administrative and social questions. He died at Kensington, June 4, 1864.

SENILIS, an old town in northern France, about 30 mi. from Paris. It has an interesting cathedral, built

in the main between 1155 and 1184. The central portal of the west front is ornamented with beautiful sculpture, and the façade is crowned by a very fine tower, of 1230. In the 13th century the transepts were added and in the 16th they were rebuilt; the lateral portals are in the flamboyant Gothic style. Before the church is a square marked by two commemorative tablets, one to Jeanne d'Arc, who won a victory on the Plain of Senlis in 1429, the other to Marshal Foch, who went from Senlis to the signing of the Armistice, Nov. 11, 1918. Senlis was the nearest town to Paris reached by the Germans in the World War; it was occupied Sept. 2-11, 1914, and much of it was burnt. The town contains interesting ruins of the castle occupied by the kings of France from Clovis to Henri IV, and much of its Gallo-Roman enceinte still exists. Pop. 1931, 7,253.

SENN, NICHOLAS (1844-1909), of Buchs, Switzerland, located in the United States in 1852, attended Chicago Medical College from which he graduated in 1868, and became professor of surgery at Rush Medical College. Senn was a great master of intestinal surgery, especially so far as concerns appendicitis. He devised a method for detecting intestinal perforation by inflation with hydrogen gas, and was the first to use Roentgen ray in the treatment of leukemia. His most noted experimental contributions include his study of air embolism, surgery of the pancreas, gunshot wounds, and intestinal anastomosis. Senn was active in the Spanish-American War and established the Association of Military Surgeons of the United States in 1891. He bequeathed many valuable medical books to the Newberry Library, Chicago. Senn died in 1909. M. F.

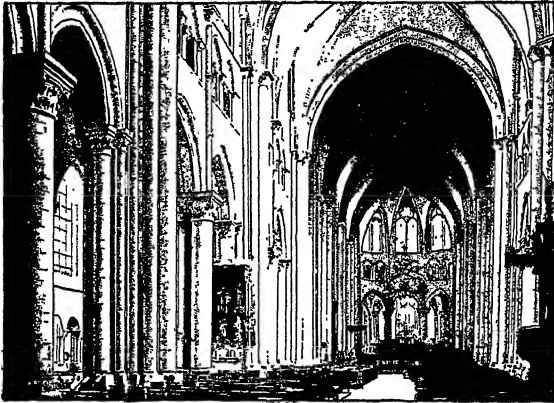
SENNA: As a purgative. See CATHARTICS.

SENNAR DAM, located on the Blue Nile, 170 mi. above Khartoum, Anglo-Egyptian Sudan, serves as both diversion and storage dam for the irrigation of the great Gezira Plain which lies between the Blue and White Nile Rivers from their junction at Khartoum southward to the dam. It is noted for its length, 9925 feet. The central portion, 5275 feet long, a granite masonry, gravity type dam, 83 feet high above channel bottom and 130 feet above the deepest foundations, is pierced by 152 flood sluiceways admitting water to the main irrigation canal. The end sections, 4650 feet long, are built partly of masonry and partly of earth fill. The dam contains 552,000 cubic yards of masonry. One of the main lines of the Sudan Government Railways crosses on top of the dam.

SENS, an old town southwest of Paris, with a celebrated Gothic cathedral. The Church Council at which St. Bernard met Abelard and denounced his doctrines was held in Sens in 1140. The town has flour mills and tanneries, and varied manufactures. Pop. 1931, 17,465.

The Cathedral of St. Étienne, the oldest of Gothic cathedrals, holds an especially interesting place in architectural history. Its builder, William of Sens, introduced French Gothic architecture into England

by his work in CANTERBURY CATHEDRAL. William began the construction of Sens in 1140, which dates the oldest portions of the cathedral as contemporary with Suger's choir in the Abbey of St. Denis. The nave and main body of the choir were finished in 1168. Somewhat rebuilt in the 13th and 14th centuries, the cathedral was completed by the addition of the transepts between 1490 and 1520. The severe, dignified west front is flanked by two low towers, the older of which does not rise above the roof-line



CATHEDRAL OF SENS, FRANCE

Nave, looking east, showing Gothic architecture of the 12th and 13th centuries

of the church. The outstanding beauty of the cathedral of Sens is found in its stained glass. Certain round-headed windows in the nave have beautiful glass of the 12th century, set in unusual medallion designs. The choir windows date from the 13th century, and in the south aisle there is a window by the noted Jean Cousin, made in 1530. The vestments of Thomas à Becket, who took refuge in Sens in 1166, are preserved in the Treasury. One of the chapels contains the tomb of the Dauphin, son of Louis XV.

SENSATION, an element of knowledge; the consciousness accompanying the stimulation of a sense organ. It is through the senses that contact is made with the external world. A sensation is therefore the beginning of knowledge. The sense organs are the receptors, the receiving stations for messages that are to be transmitted to the brain. When a receptor is stimulated the nerve current thus set up is transmitted over the afferent pathways to the brain. The resulting conscious state is known as a sensation.

The senses are like a radio receiving set. They are attuned to respond specifically to only certain types of stimuli. Just as the various points on the dial of a radio will receive only certain wave lengths, so the receptors will respond only to their specific types of stimuli. For knowledge of the world one is thus limited by the ability of the senses to respond to the external stimuli presented to them. That the receptors meet the practical purposes of adjustment is true, but they are nevertheless limited. If they did not meet practical purposes, doubtless other types of sensory apparatus would have been evolved in the long

course of evolution. How many types of vibrations there may be for which there are no corresponding sensations is only a matter for conjecture. Reception is far from continuous even between the different senses, as in the case of light and heat, and what there may be between the lower and the upper levels is purely a speculative matter.

Evolution of Sense Organs. The several sense organs have been evolved from cruder and more undifferentiated mechanisms. To begin with, the various types of sensation have but a single receiving apparatus. Going up the scale in organic evolution organs become differentiated and perfected. It follows that the sensations themselves become more distinct and refined as more adequate receiving mechanisms are developed. The first appearance of the eye is but a single pigmented cell. Compare the sensitivity of such a receptor to light with the complex delicate mechanism of the human eye. The senses of sight and hearing are regarded as higher than those of touch, taste and smell because of their greater distance receptivity. Olfaction may at times be somewhat of a rival in this respect; but its knowledge-conveying properties are slight in comparison with vision and hearing. That sight and sound have greater possibilities for intelligence is also indicated by their greater development in man and the higher animals. Contrast this with the hyperdevelopment of smell in some of the lower animals. In the struggle for existence bodily contacts played a much more important rôle than they do to-day. Hence it is not surprising that the senses requiring such contact and those most nearly connected with it should have been evolved first in the lower forms of life.

In addition to the traditional five senses, psychology now recognizes the kinesthetic sense, sense of pain, sense of temperature, and sense of equilibrium. There are three sets of end organs in the skin: namely, for pressure, for pain, and for temperature. The sense of temperature has different end organs for cold and warmth. Pressure is the technical name for what was formerly called touch. The kinesthetic sensations have their end organs in the muscles, joints and tendons and register position and movement. The end organ for the sense of equilibrium is the vestibular part of the inner ear which acts like a spirit level in determining position and movement of the body. It is a peculiarity of this sense, sometimes called the vestibular sense, that under normal conditions it does not lead to consciousness or sensation. It is only when something goes wrong that the messages from this sense become conscious.

Attributes of Senses. Each of the senses has four attributes: quality, intensity, duration and extensity, or spatial reference. Quality denotes kind of sensation. Including the combinations of sensory elements such as colors or tastes as many as 12,000 qualities may be noted. Intensity denotes the strength of sensation. For every sense there is an upper and a lower threshold, and between these a number of degrees of intensity may be noted. The increase in the intensity

of a sensation bears a constant ratio to the total stimulus. This is known as WEBER'S LAW. (See PSYCHOPHYSICS.) This proportion varies with the different senses. Thus for vision it is 1/100, the eye being much more sensitive to increased stimulation than the other senses. For warmth and sound the ratio is 1/3, and for muscular sensations it is 1/17. The connotation of duration is sufficiently explained in the term. Extensity is the original spatial character of the so-called spatial senses which are primarily sight and touch; but it is now generally recognized that all the other senses, such as hearing and pain, have spatial references which play a secondary rôle.

There is no definite line between sensation and perception. Pure sensation is more or less a myth. The first experiences of the new-born babe come as close to it as it is possible to get; but no one can recall those experiences. James refers to sensation as "acquaintance with" and perception as "knowledge about" an object.

R. N. B.

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SENSATIONALISM, the theory that all knowledge is ultimately derived from sensations. It follows from this that the senses are the main criteria for truth. Sensationalism is a form of EMPIRICISM and is opposed to rationalism. Influenced by the ATOMISM of Democritus, the Epicureans developed a sensationalistic theory of knowledge. (See EPICUREANISM.) Sensationalism reached its climax in England with the scepticism of DAVID HUME. In its extreme form it is best represented by ÉTIENNE BONNOT DE CONDILLAC (1715-80), whose example of a statue, endowed with but one sense from which all others are derived together with the highest forms of reason, is classic. The *tabula rasa* idea of JOHN LOCKE is typical of sensationalism. It conceives of the mind as blank tablet on which sensory impressions are registered; and all other intellectual processes are thought of as being traceable to this source.

SENSITIVE, a term used in several connections to indicate a person endowed with unusual or super-normal powers. When it was believed that certain persons responded to metals or ODYLLIC FORCE, or were clairvoyant, or somnambules in Mesmer's day, or were trance-mediums or crystal gazers, such persons were called sensitive or PSYCHIC.

SENSITIVE FERN (*Onoclea sensibilis*), a coarse lowland plant of the true-fern family, so named because the leaves are sensitive to early frosts and display a tendency to fold together when roughly handled. It is found in moist soil widely throughout eastern North America. The slender rootstock gives rise to large, deeply lobed sterile leaves, sometimes 4 ft. high, and smaller, much contracted fertile leaves bearing hard, rounded, berry-like divisions containing the spores.

SENSITIVE PLANTS, a small group of botanically unrelated plants, the leaves or other organs of which react rather suddenly to shock, or, more slowly, to changes in the weather. In the best-known ex-

ample, the sensitive plant (*Mimosa pudica*) of tropical America, the quick movement of leaves and leaflets is due to a sudden change of turgidity. The same phenomenon is shown by many plants of the pea and mimosa family. Of a similar origin, are the movements of the stamens of the barberry, and the movements of the leaves of certain INSECTIVOROUS PLANTS. No nervous system exists in plants. See TELEGRAPH PLANT.

SENTA or **ZENTA**, a city of Vojvodina, YUGOSLAVIA, situated about 120 mi. south of Budapest on the River Theiss, near the Hungarian frontier. It is the market center of the district, which produces maize and cattle. The city is especially famous as the scene in 1697 of Prince Eugene's brilliant defeat of the Turks. Upon the disruption of the dual monarchy of Austria-Hungary in 1918, Senta passed from Hungary to the newly created kingdom of Yugoslavia. Pop. 1931, 32,044.

SENTENCE, in ecclesiastical courts, the judgment of the tribunal analogous to a judgment in the ordinary courts at law; in criminal law, the judgment formally pronounced by the court after conviction fixing the nature and extent of the punishment. Under recent legislation sentences may be indeterminate, that is, for a period not less than nor more than so many years within a minimum and maximum fixed by legislation.

SENTIMENTALISM, a term applied to a type of literature of the middle of the 18th century which magnified the importance of sentiment and feeling at the expense of thought and action. Nearly all of the works of this type strove after psychological realism and professed a high moral purpose, but the realism was artificial and merely factual rather than artistic, and the morality was often sniggering or distorted. The most enduring work was done in the novel, especially by Sterne, by Richardson in his *Pamela, or Virtue Rewarded*, 1740, *Clarissa Harlowe*, 1748, and his *History of Sir Charles Grandison*, 1753, and by Henry Mackenzie in his *Man of Feeling*. In the theater, sentimentalism led to the dramas of Richard Steele, of George Lillo (*George Barnwell*, 1731) and of Edward Moore (*The Gamester*, 1753), and to the sentimental comedies of Richard Cumberland (1732-1811) and Hugh Kelly (1739-77). In France sentimentalism has its best examples in the *comédies larmoyantes* of Marivaux (1692-1754) and of Diderot (*Le Fils Naturel*, 1757; and *Le Père de Famille*, 1758). It found its philosophic basis in Shaftesbury and Hutcheson. See also ENGLISH LITERATURE; ENGLISH DRAMA; FRENCH DRAMA; separate articles on the above authors.

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SENTIMENTS, feelings with a dominant emotional tinge, attached to particular objects. Such sentiments as friendship, love, reverence, patriotism and honor are more than emotions. A sentiment is a

complex emotion, but differs from an emotion in that it has a more or less permanent attachment. An emotion is fleeting and transitory; a sentiment is much more lasting. It is an emotion that has become fairly well organized around an object. Sentiments are not indefinite emotional states but have very concrete attachments, such as a friend, a loved one, the deity or country.

SENTRY, a military term commonly used, interchangeably with sentinel, to indicate a soldier posted on guard duty. However, the U.S. Army regulations use sentinel exclusively in referring to the person, and sentry to indicate the duty, as a sentry post or a sentry squad, an outpost element which furnishes sentinels to guard enemy approaches.

SENUSSI, MOHAMED IBN ALI (1791?-1859), the founder of the Senussites, a Moslem fraternity, many of whose members are rich, scholarly and politically influential, and whose purpose is to revive the faith of early Islam. He was born near Mostaganem, Algeria, of an Arab tribe tracing its ancestry to Fatima, the daughter of Mahommed. After studying theology at Fez, he began at 30 to travel and preach throughout North Africa. Arriving later at Mecca, he became associated with Mohammed ben Idris el Fassi, the head of the Khadirites, whom he succeeded as chief of one of this fraternity's two branches. In 1835 he founded his first monastery near Mecca. At Cyrenaica he built the famous "white monastery," but opposed by the Turks, went to Jaghbub, an oasis near Siva, where he died in 1859.

SENUSSIS, or al-Sanusiya, an ascetic, mystical, militant brotherhood of Moslems, deriving its name from the founder, Mohammed ibn Ali Senussi (1791-1859) who was born of Berber stock near Mostaganem, Algeria, and died in Cyrenaica, whither he went after traveling to Fex, Cairo and Mecca as a student of Islamics. In Cyrenaica he founded several *zawiyas*, or monasteries, of his order, including one at Jaghbub, 1855, where he died and is buried. For the guidance of his followers he wrote several books, providing rites of initiation, dogma and ritual (*dhikr*). After his death his immediate descendants, son, grandson, etc., assumed the headship of the order which has figured politically in French and Italian north Africa. In theory, the order is Aliite, or Fatimid.

SEOUL, or **KEIJO-FU**, capital and port of KOREA, in the main part a peninsula of Asia, now belonging to the Japanese Empire. The city is situated on the north side of the Han River, 35 mi. from the sea. The political, intellectual and commercial life of Korea is centered in the capital, now modernized with tramcars, electricity and waterworks. Foreign trade offices, and many shops selling brass, silver and earthenware, have been built. Exports include minerals, among them gold mined in the Korean mountains. Founded in 1392 by the Emperor Yo Taijo, the city first had the name of Han Yang, fortress of Han. For centuries it was the center of bloodshed and misgovernment of the Korean monarchs. Since

the acquisition of Korea by Japan in 1910, Seoul has been the residence of the Japanese governor. The city's university had a registration of 471 students in 1928. In that year there were 86,548 Japanese in Seoul. Pop. 1928, 321,848.

SEPARATION, in law, a cessation of living together by husband and wife either under decree of a court (judicial separation) or by mutual consent. Prior to 1859, the ecclesiastical courts in England would grant a separation from bed and board which was a partial dissolution of the marriage, but an absolute divorce could only be granted by Parliament. In the United States, the ordinary courts were given jurisdiction over divorce from an early period, and separations are by mutual agreement. The agreement may fix the property rights of the parties. Some states have legislation regulating the causes and terms of separation.

SEPARATORS of the centrifugal type are used for separating liquids of different density, e.g., cream from milk, or for separating solids from liquids such as chips from oil that has been used in cutting operations. Centrifugal separators revolve very rapidly and separate the materials according to their densities or weights. In separating chips from oil the chips are confined in the revolving basket while the oil is thrown off through the openings at the sides or periphery.

Magnetic separators remove iron, steel, and other magnetic metals from chips of non-magnetic materials such as brass or aluminum. The chips pass over a powerful magnet which attracts and holds the magnetic metals and allows the other material to pass on. The attracted iron is scraped from the magnet as it revolves. F. H. C.

SEPIOLITE. See MEERSCHAUM.

SEPOY MUTINY (1857), the mutiny against the British of the native troops in the Bengal army. It was almost exclusively confined to the Ganges valley and was but rarely joined by the population. The causes were varied; they were in part a relaxation of discipline in the army, in part objection to the British rule by the wealthier Mohammedans and Hindus of the United Provinces whose powers and privileges had been curtailed. Its occasion was set by the disastrous Afghan war of 1841 and the subsequent draining of India of European troops for the Crimean and Persian wars. For years the British had been aware of discontent in the native army but failed to realize the possible political allies it might find among the dispossessed native princes. The trouble over the introduction of the greased cartridge, at first at any rate, packed with animal grease sacerdotally objectionable both to Hindus and Mohammedans, aggravated the ill temper of the troops. The attempt to force the cartridge issue in the Meerut barracks on May 10, 1857 led to a minor mutiny. The mutineers marched to Delhi, were suddenly joined by the city, a new Mogul Emperor was proclaimed and the mutiny broke out suddenly throughout the Ganges valley. Few of the native states joined and the northern hillmen were only too

glad to join the British for the loot of the great rebel cities of the plains. By May 1858 the rising had been suppressed. As a result of the mutiny the Government of India was transferred from the East India Co. to the Crown.

L. R.

SEPSIS, infection from any putrescent substance containing germs, or poisoning of the system by putrescent matter. However, the term is used to cover any general infection, and the symptoms occurring when toxins or poisons from some local infection are absorbed into the blood.

The exact symptoms of sepsis depend to a great extent upon the kind of germ causing the infection. Fever is always present. There are usually chills, vomiting and loss of appetite, rapid breathing and increased pulse rate. There may also be sweats, and marked prostration. There is, in most instances, an increase in the number of white blood cells in the blood. However, in severe infections there may even be a decrease in the number of white blood cells. The urine is usually scanty.

There is no specific treatment for sepsis. Sepsis is due to so many organisms, that unless the organism in a special case is determined, the use of serums or vaccines would be valueless. The treatment is usually symptomatic, including control of the temperature and attention to the general hygiene. An abundance of fluids is always advisable.

SEPTERIA, a peculiar form of CONCRETION composed of small intersecting or radiating walls usually of QUARTZ or CALCITE. The name means "little walls." These are produced by quartz or calcite filling cracks, usually in clayey material. Subsequent WEATHERING may remove the original rock, leaving only the small network of veins of calcite or quartz standing alone, sometimes called "Desert Roses."

SEPTICEMIA, "blood poisoning" resulting from the entrance of bacteria into the blood stream. Most frequently the portal of entry is a wound—from a pinprick to an extensive open laceration, but it may be due to a dissemination of infection from an infected mastoid, from endocarditis, or from childbirth. The streptococcus is the organism present in the blood of over half of the cases. *Streptococcus hemolyticus* and *S. viridans* are the most potent causes. (See BACTERIA.) Staphylococci, pneumococci, gonococci, meningococci, the colon bacillus, and an aerobes are the causative organisms in other cases.

The disease may be sudden, fulminating and rapidly fatal; or it may continue for weeks. In any event, there is about one chance in four of recovery. Though different symptoms predominate in different cases, there is practically always a high fever and a rapid pulse. Frequently the mind is disturbed and the patient is excited or delirious. In advanced stages he may pass into a stupor. In ordinary cases the number of white cells is approximately doubled, but in severe acute cases their number is greatly reduced.

Because of the great variety of organisms, and the multiplicity of strains within the limits of a single variety, no efficient serum has been produced to im-

munize patients. Furthermore, no antiseptic can be introduced into the blood stream in sufficient concentration to kill the bacteria without also injuring the body cells. The treatment is, accordingly, general and unspecific.

SEPTICEMIC PLAGUE. See PLAGUE.

SEPTIC MENINGITIS. See MENINGITIS.

SEPTIC TANKS. See SEWAGE DISPOSAL.

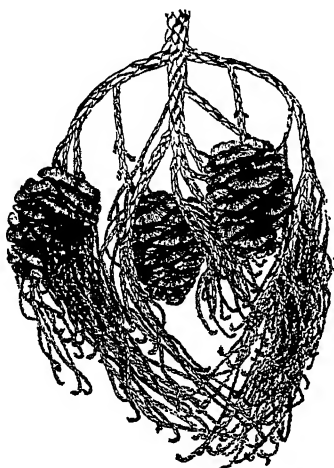
SEPTUAGINT, or the "LXX," the early Greek translation of the Old Testament. It derives its name from the legend that 70 or 72 translators from Jerusalem went to Alexandria at the request of Ptolemy II Philadelphus (288-247 B.C.) to perform the task. It contains several books and passages not found in the Hebrew version, but was generally accepted by the early Christians. All Old Testament quotations in the New Testament are from the LXX version. Its chronology also differs from the Hebrew, in that 1,500 years are added to the period between the creation and the life of Abraham.

SEQUENCE OF IDEAS, the succession or manner in which ideas appear in consciousness. The laws of association have been offered in explanation of the sequence of ideas: according to these laws, the chief methods of association are by contiguity, by similarity and by contrast. To these forms of association may be added the factors of recall as other means of accounting for the sequence of ideas. The chief factors of recall are primacy, recency, frequency, intensity and novelty. Interest also plays its part and affects the other factors. With the change from a rational to a voluntaristic psychology, the conditional reflex, with various methods of conditioning, has been used to explain this phenomenon. See MEMORY; ASSOCIATION OF IDEAS.

SEQUIN, a gold Italian coin introduced at Venice in the latter part of the 13th century, equivalent to about \$2.25.

SEQUOIA. The Miocene epoch of the Tertiary age was notable for its magnificent woodlands, doubtless the most remarkable ever known. In these woodlands the species of *Sequoia* constituted an important element, some 40 species based on fossil material having been described from stations scattered over nearly the entire north temperate region of Asia, Europe and North America and north to Spitzbergen, Greenland and Alaska. The fossil record is naturally imperfect, but there may well have been as many as 15 good species. They lived in a cool climate with rather high rainfall. As conditions changed with the gradual drying of climates only two species found suitable climatic conditions in coming down to the present age, the redwood (*S. sempervirens*) of the northern California coast and the big tree (*S. gigantea*) in the Sierra Nevada of California. In Mendocino and Humboldt counties the redwood forms the densest stands of timber known to exist anywhere. The mature trees average 6 to 16 ft. in diameter, 100 to 200 ft. high or taller and yield 30,000 to 130,000 ft. board measure per acre. Yields of over one million feet to the acre are on record. A large church at

Santa Rosa has been built from the milling of a single tree. The redwood is the tallest tree on earth, one individual measuring 364 ft. in height. The heart wood is red, without resin, and is protected by a fibrous non-inflammable bark so that the tree suffers



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CALIFORNIA BIG TREE

Branchlets with cones, one-third natural size

little from fire ravage. The wood is soft, straight-grained, durable in contact with soil and is milled for many purposes in California. Unlike practically any other coniferous tree it regenerates after being felled, producing hundreds of vigorous shoots from about the old stump. In 1930 the cut of redwood lumber in California amounted to 400,108,000 bd. ft., valued at the mill at \$12,095,264.

The big tree is confined to the Sierra Nevada where



COAST REDWOOD

Branchlets with cones, one-half natural size

it is found between 5,000 and 8,000 ft., over a range of 250 mi., mostly in isolated groves. It is nearly as tall as the redwood and is the most massive tree on earth. A particular tree named the General Sherman is 272.4 ft. high with a diameter of 27½ ft. at 12

ft. above the ground and with a volume of 49,660 cu. ft. in its trunk. The wood of the big tree is similar in character to that of the redwood but is more brittle. The stump does not crown-sprout. Climatic inferences as to dry periods in past ages, based on a study of the width of the wood rings in the trunks of big trees, are fallacious, for the reason that growth does not necessarily depend on the amount of rainfall but on the amount of persistence of the early snowpack and upon temperature conditions at the growing season. The genus name *Sequoia* is supposed to have been given in honor of the Cherokee chief Sequoyah but there is no direct evidence that this was so. The most celebrated big tree groves are those most frequently visited by travelers, the Mariposa and the Calaveras. See also BIG TREES; REDWOOD.

W. L. J.

SEQUOIA NATIONAL PARK, situated on the western slope of the Sierra Nevada in east central California, was established by act of Congress, Sept. 25, 1890 and was enlarged July 3, 1926 to its present size of 604 sq. mi. This park contains the largest and finest of the remaining stands of the California Big Trees, *Sequoia gigantea*, and with the GENERAL GRANT NATIONAL PARK was created to insure the protection of these ancient giants. Several trees in the park were well beyond the sapling stage before the Egyptian pyramids were begun and thousands were flourishing at the time of Christ's birth. In size they vary from seedlings to enormous trees with base diameters of 25 to 37 ft. Many hundreds have base diameters of more than 10 ft. and are over 300 ft. in height. The largest are between 3,000 and 5,000 years old. The General Sherman Tree, without question the oldest and largest living thing in the world, has a base circumference of 102.7 ft., a base diameter of 37.3 ft. and is 273.9 ft. high. The exact age of the tree is, of course, unknown, but it is estimated by experts to be between 4,000 and 5,000 years. The tree has been badly damaged through the ages by fire but, with only 40% of live wood in contact with the ground, it continues to flourish and to produce thousands of cones bearing fertile seeds.

Among the famous big trees of the park are the Abe Lincoln, 31 ft. in diameter and 270 ft. high, the William McKinley, diameter 28 ft., height 291 ft., and the Roosevelt Tree, the most symmetrically beautiful tree in the entire forest.

Sequoia National Park is an ideal vacation ground for the mountaineer, camper and fisherman. East of the big tree groves is an area of unsurpassed mountain grandeur containing 40 peaks over 13,000 feet in height and including Mt. WHITNEY, elevation 14,496 ft., the highest peak in the United States exclusive of Alaska.

There is an extensive system of automobile roads and saddle horse and hiking trails within the park. The official season lasts from May 15 to Oct. 1, but the park is always open for visitors carrying their own camping equipment.

The park is 236 mi. from Los Angeles and 262 mi.

from San Francisco via the National Park-to-Park Highway. From May 25 to Sept. 15 inclusive, an auto stage runs between the town of Exeter on the Santa Fé and Southern Pacific systems and Giant Forest, Sequoia National Park.

Among the educational facilities of the park is a museum containing significant exhibits. Lectures are given at stated times by the park naturalist and by ranger naturalists who also conduct field trips and escort caravans of automobiles to points of interest. Self-guiding nature trails are well labeled with explanatory signs giving information on biologic and geologic features. Tharp log, a hollow Sequoia log used as a home by Hale Tharp, the first white man to enter the Giant Forest, has been restored and contains many exhibits of historical interest.

SERAING, a town in the Belgian province and district of Liège, located southwest of the city of Liège on the Maas. It was once the summer residence of the prince-bishops of Liège with the former Episcopal Castle and contained many country homes of well-to-do city people. Seraing produces coal and manufactures glass; the former Abbey Val St-Lambert is a crystal factory. Most noteworthy, however, are the great machine factories founded by John Cockerill in 1821. These factories were subsequently enlarged and have become the property of a stock company. The works cover a large territory and embrace coal mines, foundries and smelting works, machine factories and boiler works which construct locomotives, machines, ocean and river ships. When Cockerill settled in Seraing, the town had but 2,000 inhabitants. Pop. 1930, 45,310.

SERANG. See CERAM.

SERAO, MATILDE (1856-1927), Italian writer, was born in Patrus, Greece, Mar. 7, 1856. Her father was a Neapolitan exile and her mother a Greek. Seroa has been called the "Italian George Sand," and she has indeed much of the French novelist's vigor. Her early journalistic training lends color to her novels, which deal mainly with the life of Naples. Among her best known novels are *Fantasia*, 1883, *Fior di Passione*, *Addio Amore* and *Paese di Cuccagna*; many of her works have been translated into English. Noted for her vigorous realism and her deft psychological analysis, Seroa ranks as one of the outstanding modern Italian novelists. She died in Naples, July 25, 1927.

SERAPHIM, celestial beings envisioned by Isaiah, in Isaiah 6:2-7, as standing above the throne of Jahweh. Each seraph had three pairs of wings, one pair covering his face, another covering his feet and the third pair used in flying. When the seraphim antiphonally praised the deity, the posts of the door moved at their voices and the house was filled with smoke. A possible derivation of the word, from the Hebrew for "burning," indicates an association of the seraphim with the concept of purification by fire. See also CHERUBIM.

SERAPIS or **SARAPIS**, in Egyptian mythology, god of the dead. The name Serapis is compounded

from Osiris and Apis, the sacred bull, which, after death, was identified with Osiris, and they were worshiped together. At Memphis and Alexandria temples were erected to Serapis, called for him Serapeums.

SERBIA, from 1882-1918 an independent kingdom in the Balkan Peninsula, now the nucleus of Yugoslavia, the Kingdom of the Serbs, Croats and Slovenes. The old Serbia embraces approximately one-third of the territorial expanse of Yugoslavia, and Belgrade is the capital of the latter kingdom as it was that of the former. The Serbs belong to the Slavic race and are most closely related to the Croats and Slovenes. Like the Russians and the Bulgarians the Serbs use the Cyrillic alphabet and are Orthodox or Greek Christians. They are believed to have come from the regions of the Dniester River and to have crossed the Danube into Balkania, as loosely federated clans, early in the 6th century.

By the middle of the 9th century these clans had become Christianized and had adopted the designation Serbs to distinguish them from the Bulgars on the east and the Croats on the west. For several hundred years they were governed by local chiefs or zupans, under the shadowy suzerainty of the Greek empire. During the 10th century they were constantly occupied in resisting the attacks of the aggressive Bulgars, and in the 11th and 12th centuries they strove unsuccessfully to throw off the control of Byzantium. Particularly conspicuous in this latter regard was Stephen Nemanja, who united all the Serbs for the first time into one political organization, and who ruled the united clans from 1165-96. But it remained for Nemanja's son, also called Stephen, to accomplish separation from the empire, 1204, while the latter was embroiled with the Crusaders. This Stephen, in fact, had himself crowned King, by the Pope in 1217, and, for safety's sake, by the patriarch in 1222. A century later, under Stephen Dushan, Serbia reached its highest apparent glory.

Power Broken by Turks. The 22-year-old Stephen Dushan ascended the throne in 1331 after having overthrown and murdered his father. Taking advantage of a civil war in the empire between two rival emperors, Stephen quickly doubled the area of Serbia at the expense of Bulgars and Greeks, and in 1346 had himself crowned Tsar of the Serbs and Greeks by a Serb patriarch of his own appointment. Three years later he issued a famous code of laws, the *Zakonik*, 1349. But in 1355, while preparing a campaign against Constantinople, he met with a sudden and mysterious death. The artificiality of Serbia's greatness under Dushan became apparent with the speed of its break-up upon his death. On June 28, 1389, only 35 years after they had secured their first foothold on the Dardanelles, the Ottoman Turks broke the power of Serbia in the great Battle of Kossovo. The anniversary of this defeat is still observed as a national day of mourning by the Serbs. For some time after their defeat the Serbs were permitted by their conquerors to retain a limited amount of self-government. But by 1459 Serbia was completely merged in the large and conglomerate Moslem empire.

The story of Serbia under Turkish control during the ensuing four centuries is much the same as that of the other Christian Balkan regions. Misgovernment, administrative oppression, murder, religious persecution and military abuse were the rule, although the distance of the region from Turkish headquarters and the mountainous character of the country enabled Serbia to escape some of the worst impositions to which her less fortunate neighbors further east were subject. At any rate, in 1804, after a particularly brutal massacre of prominent Serbs by the hated JANISSARIES, the people flew to arms in a determined effort to overthrow Turkish control. Under the able leadership of the ex-brigand and hog-dealer George Petrovich, who soon became famous as Karageorge or Black George, and benefiting from a simultaneous Russian attack upon the Sultan, the Serbs soon regained a complete control of their *pashalik* or province, 1807. Karageorge took the title Supreme Chief and set himself up as dictator.

Unfortunately the triumph of the supreme chief was destined to be short-lived, for in 1813, after the signing of the Treaty of Bucharest with Russia, the Turks concentrated on the reconquest of Serbia. Karageorge now fled to Hungary and for a time the Serbs resubmitted. In 1815, however, another leader, Milosh Obrenovich, a shrewd diplomat, renewed the contest. Milosh was more permanently successful than Black George had been and soon secured from the Turks a number of concessions in the direction of self-government. In 1817 his enthusiastic followers elected him hereditary Prince of Serbia and thenceforth until his exile in 1839 he ruled with an iron hand. Yet it was not until after the Russo-Turkish War of 1828-29 (*see* RUSSO-TURKISH WARS) that Turkey formally recognized the autonomous status of Serbia under Milosh as hereditary ruler. More than one assassination was laid at the door of Milosh, and he was strongly suspected of having been responsible for the murder of Karageorge when the latter returned to Serbia in 1817. This suspicion led to a blood feud between the Karageorge and Obrenovich families which served as a weakening influence in Serbian politics down to 1903, when the last of the Obrenoviches was killed.

Granted Independence. Serbia remained as an autonomous part of the Ottoman empire until 1878 when, as a result of the Russo-Turkish war of 1877-78 and the deliberations of the CONGRESS OF BERLIN, she was granted full independence. In 1882 Prince Milan took the more high-sounding title of King of Serbia.

Domestic politics in Serbia between 1878 and 1914 were marred by the feud between the Karageorge and Obrenovich families, a quarrel which was made all the more serious since the latter family was allied with the aristocratic elements in the country while the former was supported by the Liberal and Radical groups. The confusion was increased still further in 1885 when Serbia made an unprovoked attack upon Bulgaria which had recently become enlarged through the incorporation of Eastern Rumelia. The Serbs were badly

beaten, and only the diplomatic intervention of Austria-Hungary saved them from serious losses. King Milan, who had sponsored the disastrous war, tried to regain popularity by granting a liberal constitution in 1889, but two months later he deemed it advisable to abdicate. His son Alexander later suspended the constitution and in this and other ways made himself quite unpopular. In a palace plot of 1903, accordingly, Alexander, his Queen Draga, the cabinet, and some 50 other persons were brutally murdered, June 11. Thus ended the Obrenovich line. The murderers calmly placed the grandson of Karageorge, Peter, on the throne.

From the time of Peter's accession the Serbs were obsessed with the idea of a Greater Serbia, a Nationalist scheme to unite in one political state all the Serbs: those in Serbia, in Montenegro, in Bosnia and Herzegovina, in the Sanjak of Novi-Bazar, and in Macedonia. In this idea, of course, Serbia was encouraged by Russia and opposed by Austria-Hungary and Italy. With her large Slavic minority the Dual Monarchy naturally looked with disfavor upon the growing Serbian nationalism, and neither Austria-Hungary nor Italy had any desire to witness the appearance of another powerful competitor along the Adriatic coast. When Austria-Hungary in 1908 annexed outright the provinces of Bosnia and Herzegovina, which she had been occupying ever since 1878, Serbian hatred reached a frenzy. Economic rivalry and in particular the lack of a Serbian outlet to the sea added fuel to the flame of national resentment, and soon secret societies such as the *Narodna Odbrana*, or Black Hand, were formed to promote the Slavic cause and to carry on a vigorous anti-Austrian propaganda.

Balkan and World Wars. Preliminary to the inevitable struggle with Austria-Hungary Serbia participated in two expansionist wars of 1912 and 1913, the BALKAN WARS. The first of these was a cooperative attempt on the part of the Christian Balkan states to appropriate as much land as possible from the disintegrating Turkish empire. The second was a quarrel over the spoils, with Serbia acting as chief aggressor. These wars not only upset the delicate diplomatic balance and fine political alignments in the Balkans, but by strengthening Serbia and other anti-Austrian states and by weakening pro-German Turkey, also served as a bloody prelude to the WORLD WAR. And for that catastrophe Serbia, too, furnished the occasion.

On June 28, 1914 a Bosnian student, in the name of nationalism and freedom, killed the Austrian Archduke Francis Ferdinand and his wife. The assassin, Gavrilo Princip, had received encouragement and aid, including instruction in pistol shooting, from high Serbian officials. Some of the Austro-Hungarian statesmen, accordingly, felt that the Dual Monarchy must strike at once or else face the prospect of continued Slavic undermining of her political existence. On July 28, 1914 after Serbia's rejection of an unusually severe ultimatum, therefore, Austria-Hungary declared war. During the resultant World War Serbia was overrun by Austro-German and Bulgarian troops.

Yet the Serbs and other Southslavs in Serbia and in Austrian territory were optimistic enough to sign a pact at Corfu, July 1917, agreeing upon unification after the war in a large kingdom of Serbs, Croats and Slovenes under the Serb King Peter. And as a result of the fortunes of the war, this ambition actually was achieved in 1918. The new state was called YUGOSLAVIA.

W. C. L.

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SERBO-BULGARIAN WAR, 1885. See **SERBIA**.

SERBO-CROATIAN, the most important of the South SLAVIC linguistic group, spoken by about 8,500,000 people in Yugoslavia. Three main dialects are distinguished according to the varying pronunciations of the word for "what": Štokavian in the east ("what" = *što*), Čakavian in the south ("what" = *ča*), and Kaykavian in the northwest ("what" = *kay*). The latter is spoken especially in Croatia and is often termed Croatian, while the two former together are called Serbian. The southern dialect is the literary language both in Serbia and in Croatia, but the alphabets differ, the Orthodox Serbs using Cyrillic, and the Roman Catholic Croats employing Latin characters. Formerly the Čakavian domain was much more extensive, and its dialects are of great linguistic importance because of their system of free ACCENT, as in RUSSIAN, with which they frequently coincide. This scientific value is enhanced by the fact that the Serbo-Croatian dialects, like SLOVENIAN and the BAL TIC languages, show several different kinds of syllabic accent, or intonation.

A. SE.

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SERBS, CROATS AND SLOVENES, KINGDOM OF. See **YUGOSLAVIA**.

SERES, a town in Greek Macedonia, seat of the nomarchy of the same name and residence of an archbishop. It is in the center of a very fertile plain in which grain, cotton, tobacco and skins are the chief products. The old town creeps up the slope of a hill at the top of which is an old castle; the new quarter built recently extends into the plain and comprises the business district. In the 14th century the Serbian emperor Stephan Dushan made Seres his capital. In the 15th century the Turks captured it from the Serbs and retained it until 1912 when it was occupied by the Greek army. In the second Balkan War in 1913 and later during the World War the Bulgarian army invaded the city, and in 1918 it was ceded to Greece. Pop. 1928, 29,640, mostly refugees from Asia Minor.

SERFDOM, a system of land tenure by which the tenant in return for the right to use the land and be defended against enemies agrees to furnish the landowner with a part of the produce or labor, usually a specified amount. The system differs from tenant farming in three important respects: the landlord exercises whole or partial sovereignty over the tenant;

the tenant receives from the landlord not only the right to use the land, but protection as well; the tenant may not leave the land without the owner's consent. The last provision was not regarded by peasants as onerous since they rarely wished to leave the land. More objectionable was the occasional right of a lord to sell his serfs to farm the lands of another lord.

In western Europe in historical times the institution of serfdom became interlaced with political factors. With the decay of central government the powerful landlords tended to exercise power on their own account, and to their relation of landlord towards their tenants was added that of sovereign towards subject. In the course of time the sovereignty of the landlords was gradually taken from them by the central governments, and the increasing use of currency tended to substitute money rent for produce and labor dues. As early as the 13th century serfdom was disappearing in western Europe. In England the serf became a copyholder; in France the Revolution of the late 18th century swept away its last vestiges; in central Europe serfdom remained until the early 19th century. It survived longest in Russia and was there legally abolished only in the latter half of the 19th century.

Serfdom was by no means confined to medieval and early modern Europe. It was common in ancient civilizations, notably in early Egypt, Sparta, and the late Roman Empire, and with certain variations has been widely diffused throughout the world. The system of PEONAGE in the western world is closely akin to it.

SERGEANT or **SERJEANT**, a noncommissioned military officer ranking immediately above a corporal, also a subordinate police officer. In military use, sergeants are generally designated according to their particular duties, e.g., color sergeant. A staff sergeant is a sergeant attached to the noncommissioned staff of a commander; a sergeant major is a warrant officer who assists the adjutant.

SERGEANT FISH (*Rachycentron canadus*), a large marine fish, allied to the mackerels, called also cobia and crab-eater. It is found widely in warm seas and ranges northward on the American Atlantic Coast to Cape Cod. The sergeant fish, which occasionally attains a length of 5 ft. and a weight of 60 lbs., somewhat resembles the Pike in form, having a spindle-shaped body, and a broad pointed head flattened on top. It is dark green above and lighter below with a black stripe along each side from head to tail, like the stripe on a sergeant's trousers. It is strong, swift and voracious, feeding largely on bottom-dwelling fishes and crabs, is esteemed as a game fish and is used to some extent for food.

SERGIUS, ST. (2nd century), Christian martyr, was born in Italy and became an officer in the Roman Army. His conversion to Christianity was the signal for his martyrdom. His cult spread rapidly in the early Church and his feast day is celebrated on Feb. 7.

SERGIUS, ST. (4th century), monk and Christian martyr, was born in Cappadocia, Asia Minor. He

was one of those who fell a victim to the persecutions of the Emperor Diocletian, and is famous for the bold answers he gave to his heathen judge at the time of his martyrdom. The cult of this saint is widespread in Syria. His feast day is celebrated on Feb. 24.

SERGIUS, the name of four popes. St. Sergius I, 687-701, was a Syrian, whom Justinian II attempted to arrest and depose. He was defended by the soldiers, however, and it was Justinian who was deposed. Sergius II, Pope from 844 to 847, was consecrated without awaiting the *missi* of Emperor Lothair I. Subsequently, however, he took the oath of allegiance and crowned Lothair's son Louis King of Italy. Sergius III was Pope from 904 to 911. Though elected in 897, he was not recognized until 904, when the notorious Theodora and Marozia supported him. Christopher was antipope during part of his reign. Sergius IV, Pope from 1009 to 1012, was led by Patricius Crescentius.

SERICITE, a form of the MUSCOVITE variety of mica, which occurs in aggregates of small, silky scales. It is usually the product of the WEATHERING of FELDSPARS and minerals of similar composition, and is often the result of METAMORPHISM. Sometimes schists contain large quantities of sericite, and are then known as sericite schists. See also MINERALOGY; PETROLOGY.

SERIEMA (*Cariama cristata*), a large, long-legged bird native to the open plains of Brazil and Paraguay.



Standing about two feet high with an upright stately carriage it resembles the secretary bird in form but in structure is closely allied to the cranes. Its plumage is buffish gray above and whitish beneath, with a conspicuous blackish crest at the base of the red bill. The seriema lives in the tall grass, going about in pairs and small parties, but it roosts and also nests in trees, laying two blotched eggs. It is diurnal in habit, feeding upon insects, snails, lizards, snakes, small mammals, and also fruits; its loud screaming cry is heard mostly at nightfall. In Brazil, where it is protected by law, the seriema is readily domesticated, and sometimes serves as a protector of poultry. There is but one other species in the family *Cariamidae*, a somewhat smaller bird of northern Argentina, the chuñea or Burmeister's cariama.

SERIES, a succession of terms formed according to some law. The customary notation in mathematics is $u_1 + u_2 + u_3 + \dots + u_n + \dots$, where the u 's stand for any numbers, real or complex, or for functions of a variable x . Illustrations of real numerical series are

$$1 + 3 + 5 + 7 + \dots + (2n - 1) + \dots,$$

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \frac{1}{2^{n-1}} + \dots,$$

$$1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{n} + \dots$$

In the first illustration the difference between any term and the one before it is constant. Such a series is called an *arithmetic series*. In the second, the ratio between any term and the one before it is constant, and the series is called a *geometric series*. The third series belongs to a class known as harmonic, the reciprocals of the terms forming an arithmetic series.

A series may contain a finite number of terms. In this case the chief problem consists in finding the sum of the first n terms. In the general arithmetic series, $a + (a + d) + (a + 2d) + \dots + [a + (n - 1)d] + \dots$ this sum is given by $S_n = \frac{1}{2}n[2a + (n - 1)d]$. For the general geometric series, $a + ar + ar^2 + \dots + ar^{n-1} + \dots$ the sum is $S_n = \frac{a - ar^n}{1 - r}$.

Other series with their sums are

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{1}{6}n(n+1)(2n+1)$$

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left[\frac{1}{2}n(n+1)\right]^2$$

If the indicated sum of terms in the series does not terminate, the series is called an *infinite series*. Infinite series are of fundamental importance in calculus. Let S_n represent the sum $u_1 + u_2 + \dots + u_n$. As n increases indefinitely, S_n may or may not approach a limiting value. If S_n does approach some finite number K as a limit as n grows indefinitely large, the series is said to be *convergent*, and K is called the sum. If a series is not convergent it is called *divergent*. The series $1 + \frac{1}{2} + \frac{1}{4} + \dots +$

$\frac{1}{2^{n-1}} + \dots$ is convergent and its sum is 2. Every infinite geometric series in which the ratio is numerically less than unity is convergent and its sum is $a/(1 - r)$. A repeating decimal can be expressed as such a series. For example, 0.636363... can be written as the series $\frac{63}{10^2} + \frac{63}{10^4} + \frac{63}{10^6} + \dots$ in which $a = \frac{63}{100}$ and $r = \frac{1}{100}$. It follows that the sum is $a/(1 - r) = \frac{7}{11}$. By proceeding in this fashion every repeating decimal can be expressed as the quotient of two integers.

The harmonic series $1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n} + \dots$ is an example of a divergent series. By adding enough of its terms it is possible to get a result arbitrarily large.

A series of alternately positive and negative terms is known as an *alternating series*. Such a series is convergent if the numerical values of its terms decrease and approach zero as a limit. For example, the alternating series

$$1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots + (-1)^{n-1} \frac{1}{n} + \dots$$

is convergent. If an alternating series is convergent and if the series of its absolute or numerical values is also convergent, the series is said to be *absolutely convergent*. The alternating series given above is not absolutely convergent. If a series is convergent but not absolutely convergent, its terms may be rearranged so that the sum is any number we please. (See INFINITY.) Such a series may even be made divergent. There is a sharp contrast here between the sum of a finite number of terms and the sum of an infinite number. In a finite sum the order of the terms may be changed without affecting the result, but the same is not generally true in an infinite sum.

There are many tests for determining convergence or divergence. The best known is the ratio test. According to this test, a series is convergent if the limit of the numerical value of $(u_{n+1})/u_n$ as n increases indefinitely is equal to a number which is less than unity, and divergent if the limit is a number greater than unity. If the limit is unity, the test fails.

A series of the type

$$a_0 + a_1x + a_2x^2 + \dots + a_{n-1}x^{n-1} + \dots$$

is known as a *power series*. By using the methods of calculus we can expand functions into power series. For example

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

$$\log(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots$$

$$\arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \dots$$

These expansions are valid for the values of x for which the series are convergent. Series of this type are used to determine approximate values of π , e , and the logarithmic and trigonometric functions. By substituting $x=1$ in the series for $\arctan x$ we get $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$. The same series together with the identity

$$\frac{\pi}{4} = 4 \arctan \frac{1}{5} - \arctan \frac{1}{239}$$

was used by William Shanks (1874) to compute π to 707 decimal places.

A series of the form

$$a_0 + (a_1 \cos x + b_1 \sin x) + (a_2 \cos 2x + b_2 \sin 2x) + \dots$$

where the a 's and b 's are constants determined according to some law, is called a *FOURIER SERIES*. These series are important in mathematical physics. They originated in connection with a problem on the vibration of strings.

In practical problems which involve infinite series care must be taken to see that the series are convergent. Many false conclusions have been reached in analysis because a series used was divergent. Divergent series are not completely valueless, however. Many important contributions to mathematical theories have been made by researches on them. One type, called asymptotic series, has been used to advantage in celestial mechanics to calculate planetary orbits.

The concept of series, like so many other important concepts in mathematics, is very old. Examples of elementary numerical series occur in the Rhind Papyrus (c. 1700 B.C.). The Pythagoreans, Euclid, Archimedes and the Hindus knew some types. However, it was not until the time of Newton and Leibniz that the problems of infinite series gained great importance. Gregory (1668) introduced the words "convergent" and "divergent." Euler and Gauss advanced the theory, but it remained for Abel and Cauchy to apply real mathematical rigor to the study. Since their time the names of almost all the great analysts have been connected with infinite series. J. C. H.

SERMON, an address of a religious or theological character delivered in a church usually by a qualified minister of religion. In its highest examples it is a distinct literary form, notwithstanding that various attempts to systematize it by rules have invariably led to artificiality and pedantry in the resulting composition. The most famous preachers of sermons have been Frenchmen, with BOSSUET (1627-1704) at their head. He has been termed the greatest preacher that the world has ever known and his *Oraisons Funèbres* are among the most celebrated productions of the literature of his country. The first great English preacher was WYCLIFFE, while later in Scotland JOHN KNOX, the critic of Mary Queen of Scots, became an historical character by means of his sermons. The 17th century was the great day of sermons in England as in France, JEREMY TAYLOR being the greatest English preacher of this period. In America COTTON MATHER was the first great preacher of sermons, while the religious eloquence of JONATHAN EDWARDS was such as to entitle him to rank as the leading preacher of the time in this country. Famous American preachers of more recent years have been WILLIAM ELLERY CHANNING, HENRY WARD BEECHER and PHILLIPS BROOKS.

SEROW, a large goat-antelope (*Nemorhaedus bubalinus*) native to the Himalayan region. It frequents high, rough foothills, and is a powerful climber. The coarse hair on the back is black and forms a

mane on head and shoulders, but the sides of the animal are bright red and its lower parts are white. The serow is nowhere numerous, and can be captured only by aid of native dogs.

SERPENS (gen. *Serpentis*), the snake, a long constellation divided into two parts, the head and the tail, by Ophiuchus, the snake carrier. The head lies just under Corona Borealis, while the tail extends as far east as Aquila. Both consist largely of a number of stars of the third and fourth magnitude. See *STAR: map*.

SERPENTINE, both a mineral and a rock name. The mineral is usually some shade of green, but yellow, red, brown, gray and black occur. It has a waxy appearance, a slightly greasy feel, and is relatively soft. Although monoclinic, it does not occur in crystals, but in massive, fibrous, and platy forms. Chrysotile Asbestos is a fibrous serpentine. Translucent pieces are sometimes cut cabochon as gems. Serpentine results from the WEATHERING or METAMORPHISM of such magnesium minerals as PYROXENE, AMPHIBOLE, and OLIVINE. It is a hydrous magnesium silicate.

Serpentine rock consists largely of the mineral, but silica, and the remains of other rock-forming minerals of the original rock may be found. Peridotites, amphibolites, and hornblende schists, especially, alter to serpentine.

The rock is used as an ornamental stone. Verde antique is serpentine veined with calcite. Nickel and chromium ores are sometimes found in it. It is of widespread distribution. See also CHRYSOTILE; CHROMITE; GARNIERITE; GEM STONES; CHLORITE; PETROLOGY.

SERPUKHOV, administrative center of the Serpukhov district of the Moscow Region of the R.S.F.S.R. The Nara and Oka rivers join near Serpukhov. In the city is an old fort constructed by Ivan the Terrible in 1556 to protect the Moscow road against the Tatars. A monastery built in 1373 and a nunnery with two remarkable churches dating from the 17th and 18th centuries are nearby. Chintz made in the extensive textile mills of Serpukhov is famous. The Oka brings lumber and grain to the city to be reshipped to Leningrad and Moscow. Pop. 1926, 55,949.

SERRA JUNÍPERO, MIGUEL JOSÉ (1713-84), Spanish friar and founder of missions in California, was born at Petra, Island of Majorca, on Nov. 24, 1713. Entering the Franciscan Order in 1730, he assumed the religious name of Junípero. He was ordained priest on Sept. 15, 1731. On Aug. 28, 1749 he sailed for America to undertake missionary work in Mexico. Landing at Vera Cruz, he traveled on foot to Mexico City. For many years he traveled over Mexico founding missions and converting the Indians. In 1767 he was nominated head of the missions of Lower California and instructed to continue the work of the Jesuits, who had been expelled from that province. In 1769 he was invited with several other Franciscans to accompany a military expedition to Upper California, then a part of Mexico, with the idea of Christianizing and civilizing the Indians. Junípero

reached San Diego on July 1, 1769, and there on July 16 founded the first of 21 Franciscan missions in California which finally stretched along the coast for 600 miles. He himself founded the missions of San Carlos, San Antonio, San Gabriel, San Luis Obispo, San Francisco, San Juan Capistrano, Santa Clara and San Buenaventura, the last being founded two years before the missionary death. The Indians lived at the missions and received not only religious instruction but also training in agriculture and the associated trades. Junípero was a man of saintly character, humble, deliberately seeking the most obscure tasks, and sedulously avoiding all honors or glory. He died at Monterey, Aug. 28, 1784, and is buried in the church he built. His memory is revered in California, and there are monuments to him in Monterey and in Golden Gate Park, San Francisco.

SERRANO, a North American Indian tribe of the Shoshonean linguistic stock. They occupied the San Bernardino mountains in southern California north of Los Angeles and the Mohave River to Daggett, and the Mohave Desert to the Tejon Creek Valley. Early during the Spanish occupation they were brought under the control of the missions of San Gabriel and San Bernardino. The survivors of the group were attached to the Mission Agency. In former times they were the trading intermediaries between the inland and coast tribes. They lived in square communal houses of tule mats over a willow frame and made baskets and vessels inlaid with mother-of-pearl. They seem to have been scantily clothed and to have worn some undescribed type of otter and rabbit-skin robes. For food they depended chiefly on wild game and roots.

SERUG, according to the genealogical, or as some hold the ethnological, tables of the BOOK OF GENESIS, is mentioned as the son of REU and the great-grandfather of ABRAHAM, in the line of SHEM and NOAH. Like other personal names in Genesis, Serug has been identified with tribal and place names, and was, according to Assyrian inscriptions and Arabic writers of the Middle Ages, a city or district 38 miles west of Haran, confirming the Biblical testimony that the ancestors of the Hebrews came from western Mesopotamia.

SERUM. See BLOOD.

SERUM SICKNESS. See ALLERGY.

SERUM THERAPY, the treatment or prevention of disease by the injection of serum obtained from the blood of animals or from other human beings. The serum may be used to produce passive immunity which gives protection against the disease for only a short time. On the other hand certain serums may be used to produce active immunity.

Some of the serums are in the nature of ANTITOXIN. Antitoxins are used in producing passive immunity against diphtheria and in preventing tetanus or lockjaw. A mixture of diphtheria antitoxin with an equal amount of toxin is used to produce active immunity against diphtheria. In preparing the antitoxin, the specific toxin formed by the germs of diphtheria or

tetanus is injected into a horse in slowly increasing doses, until the serum of the animal becomes sufficiently rich in antitoxins formed to combat the toxin. The serum is then withdrawn from the animal, sterilized and standardized.

When a person has been exposed to diphtheria or has suffered a wound which may possibly have become infected with tetanus germs, a protective dose of the appropriate serum is administered in order to ward off the disease. In patients already suffering from these diseases, much larger doses of the antitoxin are needed for treatment.

In certain diseases the dead bacteria themselves are injected into the animal to produce a protective serum. Such a serum is styled an anti-bacterial serum. Examples of this type are anti-streptococcal and anti-meningococcal serums.

It sometimes happens that many varieties of one organism are involved in causing a disease, and it may not be clear which is the causative agent in any particular case. For such diseases serums are manufactured by using all the different varieties of the germ. Such serums are called polyvalent serums.

It has been found that the serum taken from an individual who is convalescing from measles or infantile paralysis has value in preventing these diseases. When given early enough after exposure, the convalescent measles serum will prevent the disease or make its course much more mild. The infantile paralysis serum, when used promptly, will often forestall the paralysis that occurs in this disorder.

It has also been found that the serum taken from the blood of any individual, whether he has apparently had infantile paralysis or not, will also be of value in the treatment of this disorder. This seems to be due to the fact that all individuals at some time or other have a mild attack of this disease.

Antibacterial serums have also been prepared for the treatment of pneumonia and erysipelas.

The serums may be given by subcutaneous injection or intravenous. Reaction to the serums called serum sickness may occur. The symptoms usually appear about the eighth to the tenth day after the inoculation. W.I.F.

SERVAL, a large African wild cat (*Felis serval*). It attains a length of $4\frac{1}{2}$ ft. including the tail which is about a foot long; is lightly built, long-legged, and nocturnal in habit. The serval is found widely throughout Africa, especially in rough and brushy country. Its tawny, occasionally black, coat is handsomely marked with dark spots which become stripes on neck and shoulders, and is valued in the fur market.

SERVETUS, MICHAEL (1509-1553), Spanish physician, also known as Miguel Servete, announced in his book *Restitutio Christianismi* the discovery that pulmonary circulation passes into the heart after having been combined with air in the lungs. There are but two copies of this book available, one in Paris and another in Vienna. His theological views were condemned by Catholics and Protestants. Cal-

vin had him imprisoned in the summer of 1553 and he was burned at the stake on Oct. 27.

SERVIA. See **SERBIA**.

SERVICE, ROBERT WILLIAM (1874-), Canadian poet, was born at Preston, England, Jan. 16, 1874. He was educated at the Hillhead High School, Glasgow. In 1905 he emigrated to Canada, farmed on Vancouver Island and traveled throughout the Northwest. Through his later connection with the Canadian Bank of Commerce he became familiar with the Yukon and the subarctic, the subject matter of his most popular verse, *Songs of a Sourdough*, 1907 and *Rhymes of a Rolling Stone*, 1913. His Yukon experiences appear also in *The Ballads of a Cheechako* and *Ballads of a Bohemian*, 1920. Of all his well-known ballads of the North, the best known is *Dangerous Dan McGrew*. Service's *Rhymes of a Red Cross Man* describe his experiences as an ambulance driver in the World War. *The Trail of '98* a novel published in 1910, gives a vivid picture of the Klondike; three later novels are *Poisoned Paradise*, 1922, and *The Roughneck*, 1923, and *The House of Fear*, 1927.

SERVICE BERRY, a genus (*Amelanchier*) of small trees and shrubs of the rose family, closely allied to the apple. There are about 25 species, native chiefly to North America, several of which are sparingly planted for their showy, very early, white flowers or their edible berry-like fruit. Among the most important are the American service berry (*A. canadensis*), known also as shad bush and June berry, found in the eastern states, and the western service berry (*A. alnifolia*), found from Idaho to Oregon northward to Alaska. The dried fruit of the latter was formerly much used for food by the Indians.

SERVICE SCHOOLS, ARMY AND NAVY. See **ARMY SCHOOLS; NAVY SERVICE SCHOOLS.**

SERVICES OF SUPPLY, the organized coordination, effected in the American Expeditionary Forces in France, of all the different army branches, which was charged with supply and transportation for the combat troops. It functioned centrally as an entirety, without interference of any one service with another, it being designed to operate as a well-regulated machine with resulting central control and general cooperation. This term, as used in France during the World War, was not a true counterpart of that delimited area in a theater of operations known as the Communications Zone or Lines of Communication and in which the major supply activities for the maintenance of military operations were conducted. The organization of the Services of Supply (SOS) of the American Expeditionary Forces in France was evolved as a result of the special conditions imposed by the military operations conducted in cooperation with the other Allied Armies, and was built up and organized so as to serve a special sector of the Western Front assigned to the American Army, it being necessary that the organization and methods of operations conform to and be coordinated with the territorial subdivision in France. The supply branches of the Army

are Quartermaster Corps; Medical Department; Corps of Engineers; Ordnance Department; Signal Corps; Chemical Warfare Service; Air Corps and the Coast Artillery Corps. J. L. D.

SERVICE STRIPE. See **STRIPE**.

SERVICE-TREE (*Sorbus domestica*), a medium-sized tree of the rose family closely allied to the apple. It is a native of the Mediterranean region cultivated in Europe for its edible fruit. In size and appearance it is very similar to the European mountain ash or rowan tree. It grows about 50 ft. high, bearing pinnate leaves, numerous flowers in pyramidal clusters, and apple-shaped or pear-shaped fruit about an inch long.

SERVILE WARS, actually slave insurrections in antiquity, of which two were serious. The first, in Sicily, was the result of an investigation by the Romans to determine the status of men sold in that province by recently subdued pirates. The freeing of several hundred slaves aroused the rest, and a revolt of four years' duration, 103-99 B.C., broke out. A generation later in central Italy another insurrection was started by Spartacus, an enslaved bandit, who made Vesuvius his headquarters, and gathered a force of 100,000 slaves. The Romans, as before, were slow to appreciate the extent of the outbreak, and the war lasted two years, 73-71 B.C.

SERVISS, GARRETT PUTNAM (1851-1929), American author, was born in Sharon Springs, N.Y., Mar. 24, 1851, and educated at Cornell University. After spending the years 1882-92 as editorial writer for the *New York Sun*, he devoted himself to writing and lecturing on history and astronomy. His several publications include *Astronomy With an Opera Glass* and novels of a semi-scientific nature such as *The Conquest of Mars*, *The Moon Metal*, *The Second Deluge* and *The Moon Maiden*. Serviss died in Englewood, N.J., May 24, 1929.

SERVITES, ORDER OF (Servants of Mary), the fifth mendicant order in the Roman Catholic Church, founded on the Rule of St. Augustine by seven Florentine youths of patrician stock at La Camarzia in 1233; later transferred to Monte Senario. First officially approved in 1249, within 100 years the Order had established missions in Crete and India and more than 100 houses throughout Europe. There are now 120 monasteries, convents and missions in nine provinces and 14 vice-provinces, with over 1,000 members. A Second Order, Servite nuns, has existed since 1619 and the Mantellate, a Third Order, since about 1284. Other affiliations are a secular third order and a confraternity of the Seven Dolors.

SERVITUDE, in international relations, a right or privilege enjoyed by one state within the jurisdiction of another. Servitudes rest on treaty or usage, are extraordinary or perpetual in character, and are construed strictly for the dominant state and liberally for the servient state. They may be reasonably regulated by the servient state, but the regulations cannot have the effect of defeating or terminating the servitude. They may be ended by agreement, by renunciation

on the part of the dominant state, and sometimes by the unilateral revocation of the servient state.

SESAME (*Sesamum orientale*), a small annual herb of the pedaliaceae family, widely cultivated in tropical regions for its oil-bearing seeds commercially known as "bene." The plant, believed to be a native of the Sunda islands, was introduced in ancient times to India, Egypt and other warm countries. Herodotus, Theophrastus, Dioscorides and Pliny mention its cultivation. The bland oil expressed from the seeds, known as sesame, gingelly or til oil, is extensively used for food and other important purposes.

SESAME, OPEN. In the tale of *Ali Baba and the Forty Thieves* in the *Arabian Nights*, the magic password which would open the door leading into the mountain cave of the robbers.

SESAME GRASS (*Tripsacum dactyloides*), a wild fodder grass closely allied to maize and teosinte, called also gama grass. It is native to moist soils from Connecticut to Kansas southward to Florida and Texas. The plant is a robust perennial, 3 to 6 ft. tall, with broad leaves and conspicuous flowering-spikes, the seed-bearing parts of which break up into bony joints. It forms hybrids with teosinte and maize.

SESTET, the last six lines of a sonnet, in which the emotional setting of the preceding eight lines or octave makes a distinct shift and is fulfilled. The most familiar arrangements are found in the sonnets of Shakespeare (a quatrain and a couplet: *abab cc*), in the early Italian or "Petrarchan" sonnets (*cde cde, cdc dcd*, and others), and in the ordinary rhyme-scheme, *abc abc*. The 16th century French sestet, *aab, ccb*, may also be noted.

SESTINA, a verse-form probably invented by Arnaut Daniel (13th century), much favored in medieval Provence and Italy. It consists of six 6-line stanzas, originally in blank verse, so arranged that the final words of the first six lines appear in varied order in the succeeding stanzas, thus: *abcdef, faebdc, cfdaeb, ecbfad, deacfb, bdfeca* (which may be followed by a *tornado* or envoi). In the 19th century the sestina was skilfully used by the Comte de Gramont (*Chant du passé*, 1854) and, in English, by SWINBURNE and EDMUND GOSSE.

SET, in Egyptian mythology, god of evil and darkness, was son of SEB and Nut, brother of Osiris and Isis, and husband of Nephthys. He hated his brother Osiris and, killing him, scattered his body in fragments over the land. Horus, son of Osiris, avenged his father's death.

SÈTE or **CETTE**, a French seaport on the Mediterranean in the department of Hérault, about 20 mi. southwest of Montpellier. Although a very old town, the Mons Setius of the Romans, Sète rose to importance only in the 17th century, with the completion of the Canal du Midi, connecting it with Bordeaux. Wines and chemicals form the exports, and canning and metallurgical factories are among the town's industrial plants. Pop. 1931, 36,953.

SETH or **SHETH**, according to the traditions preserved in the Book of Genesis, was either the first-

born or third-born son of ADAM, the authors of the traditions differing on this point. Babylonian parallels confirm that Cain (*see* CAINAN) belonged to a later generation. The BOOK OF NUMBERS (24:17) makes the Moabites the sons of Seth, probably confusing the word with the Syrian nomads, Sutu, of the cuneiform inscriptions. Post-canonical writers have much to say in the praise of Seth. Ecclesiasticus speaks of SHEM and Seth as "glorified among men." In later days there were heretical Jewish and Gnostic sects called Sethites.

SETI I (1313-1292 B.C.), Egyptian pharaoh of the 19th dynasty, was the son and successor of Rameses I, founder of the dynasty. In the first year of his reign (1313 B.C.), he started on a career of conquest, advancing as far as the northern border of Palestine. He defeated the Bedouin Shasu, and then attacked the Canaanites, Syrians and Hittites, laying waste the land with fire and sword. After returning in triumph to Egypt, he waged a victorious war against the Libyans. Later he again marched into Palestine, where his advance was checked by the Hittites, with whom he concluded a treaty of peace.

Seti now devoted himself to developing his country, digging wells, exploiting mines and undertaking extensive building projects. He restored the temples disfigured by the fanatic Akhenaten, continued the building of the great Hypostyle Hall at Karnak, and built at Abydos the magnificent temple of Osiris, called the Memnomium. After reigning over 20 years, he died and was buried in a rock-cut tomb in Western Thebes.

SETIF, a city of Algeria, lying 70 mi. southwest of Constantine, capital of the department. It is the trading center of the district, which produces fruits, particularly figs, almonds, pomegranates and dates. Leather goods and woollens are manufactured. There are large military barracks, a hospital and a museum of antiquities. Pop. 1926, 26,677.

SET-OFF, an independent claim of a defendant against a plaintiff set up by the defendant to reduce or cut off plaintiff's demand. At common law this was not allowed; each party must sue the other independently upon the independent demands. But set-off was allowed in equity in certain cases to prevent injustice. In the civil law cross demands compensate each other and nothing can be recovered beyond the balance due after deduction of set-offs. Under modern legislation in common-law countries set-offs are allowed by way of defense at least in actions upon contract.

SETON, ELIZABETH ANN (1774-1821), American philanthropist, was born in New York, Aug. 28, 1774. Left a widow with three children in 1803, she was received into the Roman Catholic Church, and in 1808 opened a school for girls in Baltimore. The following year she founded a new community at Emmitsburg, Md., modeled after the Sisters of Charity of St. Vincent de Paul. After taking vows in 1813, Mother Seton held the office of Mother Superior until her death at Emmitsburg, Jan. 4, 1821.

SETON, ERNEST THOMPSON (1860-), American author and woodsman, who wrote under the name of Ernest Seton Thompson before he changed his name, was born at South Shields, England, Aug. 14, 1860. He was educated at Toronto Collegiate Institute and the Royal Academy, London. From 1886 to 1887 he "roughed it" in the Canadian backwoods and on the Western plains, becoming a naturalist for the Manitoba government. Seton soon rose to be a well-known writer and illustrator of animal stories. In 1902 he founded the Woodcraft Indians and from 1910 to 1915 was Chief Scout of the Boy Scouts of America. Among his works are *Wild Animals I Have Known*, 1898, *Lobo, Rag and Vixen*, 1900, *Scouting for Boys*, 1910, and *Lives of Game Animals*, 1925-28.

SETTEE, a high-backed, upholstered seat with arms at each end, designed for two or more persons. Originally distinguished from the SOFA by its unupholstered back, it borrowed the characteristics of both SETTLE and CHAIR. Early examples date from about 1650. The piece quickly lost its original angular appearance in the taste for rich upholstery. It was an important and popular piece in England and France, and was usually designed in pairs and upholstered *en suite*. Chippendale's settees, fitted with two or three



COURTESY M. M. OF ART

ENGLISH SETTEE WITH GILT GESSO ORNAMENT (1720-1730)

chair backs, were heavily carved and showed the Chinese influence. Hepplewhite originated the "bar back sofa," with a four chair back and boxed seat. To-day the settee is considered as a variant of the sofa.

SETTING-UP EXERCISES, or CALISTHENICS, light physical exercises usually without apparatus, though sometimes dumb-bells, wands and Indian clubs are used. These exercises are planned to develop all parts of the body and include 20 or 30 movements. Setting-up exercises are a part of the daily training in most of the schools of the United States, and are included in the programs of boys' clubs, Boy Scout troops, Camp Fire Girls and similar organizations. They are also included in the daily training of soldiers, and are used to warm up athletes before football and other strenuous games. They have been called Swed-

ish gymnastics because many of the movements were developed in Sweden. At field days in Europe, frequently more than 5,000 men or men athletes, led by bands of music, go through a set of exercises together. In the United States, setting-up exercises are taught over the radio to early morning classes composed of listeners scattered all over the country, and some of the leaders of these classes have developed enormous followings.

See Boy Scouts of America, *Official Handbook*.

SETTLE, a long seat, generally made of wood, with a high back; distinguished from a **BENCH** by having arms at both ends. In some cases the back



COURTESY M. M. OF ART

AMERICAN SETTLE OF THE 18TH CENTURY

Constructed of chestnut, this settle stands by the fireplace in the Capen house, Topsfield, Mass.

and also the front apron extended to the floor to protect from draughts or to enclose a locker commonly built under the seat. A combined settle and beauncupboard was often used in farmhouses. Like the **CHEST**, the settle was often used as a bed. Coverings of leather or fabric or loose cushions, rendered it more comfortable; but not till the 17th century was stuffed upholstery attached. When placed against a wall under an emblazoned canopy, the settle became the seat of honor for the chief guest.

SETTLEMENT, ACT OF, 1701. See **ENGLAND, HISTORY OF.**

SETTLING or SEDIMENTATION TANKS, basins in which **SEWAGE** is retained long enough and in which the velocity is low enough to bring about the sedimentation of a part of the suspended matter, but without being delayed long enough to produce *anaerobic* decomposition. See **BACTERIA**. This applies to the plain settling tank now in use in **SEWAGE DISPOSAL** plants, and to the settling compartments of the two story Imhoff tank. In the settling tank, "sludge" is continually swept from the bottom up by revolving mechanisms and then drawn away by pumps. In the Imhoff tank the sludge slides through openings into an underlying compartment where "digestion" takes place. (See **SLUDGE DIGESTION**.) It is important, however, that the sludge be removed from contact with the sewage before bacterial action begins. Flow through the tanks is generally across it; but other systems exist such as a "radial flow" where the inlet is in the center, and the "vertical flow" where the inlet is at the bottom. The settled solids or sludge must be "digested" in a separate container to a stable condition.

In the formerly much used *Septic Tank* the sludge was allowed to remain in the settling compartment so that so much of the sludge as was digested and liquefied could pass out with the sewage effluent. This tank was effective in reducing the amount of sludge

to be handled but gave an effluent so badly filled with gases of decomposition that its discharge into the open air often gave serious odor nuisances.

In either the plain Settling Tank or the Imhoff tank retention periods of about two hours are generally satisfactory for average sewage. The shape of the tank is such as to produce the lowest possible "flowing-through" velocity. See also **SEWAGE TREATMENT**.

W. W. H.

SETUBAL, a city in the Portuguese district of Lisbon, several times the residence of the royal family, situated on the Bay of Setubal near the Atlantic Ocean. It was destroyed by earthquake in 1755. It has forts, several churches, theaters and monuments. There is considerable cultivation of fruit, and especially olives, oranges and onions. Tunny fishing and the production of cork and lace are also important industries. Pop. 1920, 37,074.

SEVEN AGES OF MAN, THE, in Shakespeare's *As You Like It* (Act II; scene 7), the seven periods of a man's life, as listed by the character Jaques. First comes the infant; then the whining schoolboy; followed by the sighing lover; then the soldier; and, growing older, the self-righteous justice; succeeded by "the lean and slipper'd pantaloon"; and, at last, the man suffers a return to second childhood. Variations occur frequently in both literature and painting.

SEVEN CHAMPIONS OF CHRISTENDOM, THE, a title applied collectively to seven great national saints. As listed in Richard Johnson's *Famous Historie of the Seaven Champions of Christendom*, published 1596-1610, they included St. George of England, St. Andrew of Scotland, St. Patrick of Ireland, St. David of Wales, St. Denis of France, St. James of Spain and St. Anthony of Italy.

SEVEN DAYS' BATTLES, June 26-July 1, 1862, in the **CIVIL WAR**, a series of engagements in the vicinity of Richmond, Va., between Gen. McClellan's Union army of 95,000 and the main army of the Confederates, under Gen. Lee, of about equal strength. At Mechanicsville, June 26, the Confederates were defeated; at Gaines' Mills, June 27, the arrival of Gen. Jackson with Confederate reinforcements routed the Federal army with great slaughter; on the 29th an indecisive battle was fought at Savage Station. The following day an affray near Frazier's Farm lasted all day, the Federal troops retreating under cover of darkness. The most notable of these engagements was the Battle of Malvern Hill, July 1. McClellan's troops entrenched themselves behind earthworks on Malvern Hill, a low plateau beside the James River. The Confederates undertook to storm the position, encountering a cannonade from the Federal gunboats on the James as well as from the earthworks. The charge was abandoned after the Confederates had suffered heavy casualties. The Federal losses in these engagements totaled 16,250; the Confederate losses exceeded 23,000.

SEVEN DEADLY SINS, THE, those sins, also called mortal sins, classified by early theologians as wilfully violating the divine law and causing the

soul's destruction. They are pride, wrath, envy, lust, gluttony, avarice and sloth.

SEVEN OAKS, BATTLE OF, June 19, 1816, in Canadian history, the armed clash which climaxed the hostility of the Northwest Fur Company toward the HUDSON'S BAY COMPANY as the sponsor of the RED RIVER SETTLEMENT. The Northwest traders were convinced that the agricultural colony would drive fur-bearing animals from the Winnipeg-Red River region. Several minor clashes had occurred before Alexander McDonnell, Northwest Co. representative, assembled a party of 62, mostly half-breeds, at Portage la Prairie, to assure the safe passage, it was later alleged, of a brigade of canoes with goods and provisions expected from Ft. William, which had to ascend the Red River to reach the Assiniboine. Ft. Douglas, the Hudson's Bay Co. post, was in a position to blockade the Red River. The Northwest party was intercepted as it reached Ft. Douglas by Gov. Robert Semple and 28 men. After angry discussion a general fusillade began. Semple and twenty of his party were killed; one of the Northwest party was killed, and one wounded. The inhabitants of the fort perforce surrendered. Lord Selkirk shortly arrived in the settlement with about 100 Swiss mercenary soldiers whom he had induced to settle there; with this group he seized Ft. William and recaptured Ft. Douglas. Subsequent litigation was unfavorable to Selkirk, and the two fur companies merged.

SEVEN PINES, BATTLE OF, called also Battle of Fair Oaks, May 31-June 1, 1862, a desperate conflict in the CIVIL WAR, fought in the suburbs (after which the battle is named) of Richmond, the capital of the Confederacy. The Union Army, pursuing Gen. Johnston in his retreat toward Richmond, consisted of 126,000 men in five corps. Two of the corps, under Generals Keyes and Heintzelman, were separated from the main body by the Chickahominy River. A sudden freshet flooding the river, Gen. Johnston decided to attack the two corps before Federal reinforcements could reach them. Using 39,000 men against the Federal force of 51,000, Johnston attacked on May 31, achieving a slight advantage. With the renewal of hostilities in the morning, the Confederates were repulsed with a loss of 6,697 men, including Johnston among the wounded. The Federal casualties numbered 5,739.

SEVEN SLEEPERS, THE, according to a Christian legend, seven noble youths of Ephesus who escaped during the Decian persecution, in 250, to Mount Coelian, where they slept for about 200 years in a cave, the entrance to which had been blocked from outside. The Seven Sleepers—named Dionysius, Constantine, Maximian, John, Serapion, Malchus and Martinian—were awakened by a shepherd, but died soon after telling their miraculous story to the Emperor Theodosius II. The legend, Syrian in origin, was first chronicled by St. Gregory of Tours (6th century).

SEVENTH DAY ADVENTISTS. See ADVENTIST CHURCH.

SEVEN WEEKS' WAR, the brief struggle in June and July 1866 between Prussia and Austria. The latter was supported by Saxony, Hanover, the two Hesses, Bavaria, Baden and Württemberg; the former by a few small North German states and by Italy. The war came about from disputes over the status of Schleswig and Holstein, taken by Austria and Prussia from Denmark in 1864. Each side accused the other of violation of the Treaty of Gastein, Oct. 30, 1864, by which the future of these districts was to be regulated; but beneath the surface disputes lay the fundamental and until then unsettled question of whether Prussia or Austria was to dominate the German Confederation, or even, as afterwards occurred with Prussia, furnish the core about which was to be built the German Empire. The war began June 14 and was pushed by Prussia with remarkable rapidity, partly from military reasons and partly to prevent Napoleon III using it to gain some advantage for France. Hanover, Electoral Hesse, Nassau and Frankfort were quickly occupied, and the army pushing into Bohemia routed the Austrians at the decisive Battle of Königgratz (Sadowa) on July 3.

A preliminary peace was signed on July 26 and the Treaty of Prague on Aug. 23. No Austrian territories were taken, and the net result for Austria was the loss of Venetia to Italy and the exclusion of German Austria from Germany. (See AUSTRIA, HISTORY OF; GERMANY, HISTORY OF.) Austria also agreed that Prussia should annex the northern states she had occupied, together with the duchies of Schleswig and Holstein, to the dissolution of the German Confederation and the formation of the North German Confederation, a body whose constitution, drawn up by Bismarck in 1867, was substantially that of the German Empire organized in 1871. Altogether Prussia increased her population by 4,500,000. Napoleon's policy was completely upset by the rapidity with which the war was won. He demanded compensation for the increased power of Prussia, first the Bavarian Palatinate and Rhenish Hesse; then when Bismarck flatly refused, he requested Landau and the Saar, and finally declared he would be content with Luxemburg and some agreement concerning a possible French annexation of Belgium. By revealing these suggestions to the south German states Bismarck won them over completely to Prussia.

SEVEN WISE MEN, THE, seven Greeks of the 6th century B.C., famed for their maxims of wisdom. Their names, with their best known sayings, are Bias ("Most men are wicked"); Chilo ("Consider the end"); Cleobulus ("Avoid extremes"); Periander ("Nothing is impossible to industry"); Pittacos ("Know thine opportunity"); Solon ("Know thyself"); Thales ("Suretyship is the forerunner of ruin").

SEVEN WONDERS OF THE WORLD, THE, the greatest productions of antiquity as known in the 2nd century B.C. They were the Pyramids, the hanging gardens of Babylon, the mausoleum at Halicarnassus, the Temple of Diana at Ephesus, the colossus

of Rhodes, Phidias's statue of Zeus, and, as the seventh, either the Palace of Cyrus or the Pharos of Egypt. The Seven Wonders of the later centuries comprised the Coliseum at Rome, the catacombs at Alexandria, the Great Wall of China, the Leaning Tower at Pisa, Stonehenge (England), the Porcelain Tower at Nankin, and the church of St. Sophia at Constantinople.

SEVEN YEARS' WAR, 1756-63, the conflict between Prussia, supported by English subsidies, and a European coalition comprised of Austria, France, Russia, Sweden, Saxony and the Empire. The war had its immediate origin in the claims of the Prussian King to Silesia, which he had seized in 1741 and retained by the terms of the Peace of Aix-la-Chapelle in 1748. But Maria Theresa was unwilling to lose the province without a further effort. She secured an alliance with Elizabeth, Empress of Russia, with the Saxon Elector Augustus III, and later, in 1755, with France. England, fearing a French attack on Hanover had turned away from her old ally Austria and concluded the Treaty of Westminster with Frederick.

Aware of the coalition against him, Frederick took the initiative himself, invaded Saxony and defeated the army of Augustus, capturing about 18,000 men whom he compelled to serve in his own army. This high handed act coupled with able diplomacy of Austria brought the German Empire into the war against him in 1757, only Hanover, Hesse, Brunswick and Gotha supporting Frederick. Undismayed by this formidable alignment of enemies against him, and encouraged by a substantial English subsidy, Frederick met the Austrians and severely defeated them in the Battle of Prague on May 6, but was in turn defeated at Kolin on June 18. Meanwhile the French took Hanover, and Russia invaded East Prussia. On Nov. 5, Frederick defeated a French and Imperialist army at Rossbach and a month later administered another defeat to the Austrians in Silesia. But he was less fortunate the next year. In 1758 the Russians took Königsberg, while the Prussians were defeated on Oct. 14 by the Austrians at Hochkirch, near Bautzen.

In 1759 the Austrian and Russian armies effected a junction and severely defeated Frederick at Kunersdorf on Aug. 12. The Imperial army captured Dresden, and one of Frederick's generals, Finck, with 13,000 men surrendered to the Austrian Daun. Next year Frederick fought desperately against the superior forces of his enemies, successfully preventing the union of the Russians and Austrians but unable to prevent the Russians from burning Berlin. In return he won another hard fought victory over the Austrians at Torgau on Nov. 3, which made them reluctant to venture on a decisive engagement in 1761. In that year, however, George III, who came to the throne in 1760, put an end to the English subsidies.

Frederick was in despair, but the death of Elizabeth of Russia brought to the throne an admirer of Frederick's, Peter III, who promptly revised Russia's

position and allied himself with Frederick in Nov. 1762. His successor, Catharine II, broke off the alliance and recalled her troops, while Sweden also made peace with Prussia. Two victories in 1762 one over the Austrians at Reichenbach and the other at Freiberg over the combined Austrian and Imperial forces, ended the fighting, the French having withdrawn after the preliminaries of peace with England at Fontainebleau in Nov. 1762. On Feb. 15, 1763 the Seven Years' War was formally brought to an end in Europe by the Peace of Hubertsburg, which confirmed Frederick in the possession of Silesia. At the same time, the Peace of Paris on Feb. 10, 1763 between England, France and Spain ended the long struggle for a colonial empire in America and India.

SEVERINUS, Pope for a few months in 640.

SEVERN RIVER, a river rising in the mountains of Wales which flows in a northerly direction into England and empties into the Bristol Channel after a course of 210 mi. It passes through Shrewsbury, Shropshire, Worcestershire and Gloucestershire, becoming an estuary noted for its high tides, and merges with the Bristol Channel where the Severn receives the Lower Avon and the Wye. Among the important rivers flowing into the Severn are the Vyrnwy, Tern and Stour. Its commercial value is increased by canals, which permit the entrance of large ships and connection with the Thames. A tunnel beneath the estuary makes a direct route between England and South Wales possible.

SEVIER, JOHN (1745-1815), American frontiersman and legislator, was born in Rockingham Co., Va., Sept. 23, 1745, of French ancestry. He attended the common schools and for a short period the academy at Fredericksburg, Va. Before his removal to the Watauga settlement in 1772 he achieved local fame as an Indian fighter. The bold courage and shrewdness of Sevier rapidly led to his leadership of the settlers. When Watauga was organized as a county of North Carolina, he represented it in the state legislature in 1777. He distinguished himself as a colonel of militia during the Revolutionary War.

In 1784 North Carolina ceded what is now Tennessee to the federal government and the same year rescinded the cession. The settlers of the region in the meantime had proceeded to organize the new state of Franklin and inaugurated Sevier as the first governor Mar. 1, 1785. North Carolina, declaring the district to be in revolt and its governor an outlaw, reasserted its authority by force of arms. Sevier was captured and imprisoned in 1788 but later released. He was elected as an anti-Federalist from North Carolina to the first House of Representatives under the Federal Constitution, serving Mar. 4, 1789 to Mar. 3, 1791. North Carolina in 1789 had again ceded its western lands to the national government which had at once organized them into the Southwest Territory. President Washington in 1791 appointed Sevier brigadier-general of militia in the territory.

When Tennessee was admitted as a state in 1796 Sevier became its first governor, serving from 1796

to 1801 and again from 1803-09. In 1810 he was elected to Congress, and was twice re-elected, serving from Mar. 4, 1811 until his death, Sept. 24, 1815 near Ft. Decatur, Ala.

SÉVIGNÉ, MARIE DE RABUTIN-CHANTAL, MARQUISE DE (1626-96), French letter writer, was born in Paris, Feb. 5, 1626. Her uncle, who was her guardian, gave her an excellent education. Endowed with beauty and a large fortune, she married, on Aug. 4, 1644, the Marquis de Sévigné, who died in 1651 as the result of a duel. Left a widow with a son and daughter, Madame de Sévigné henceforth divided her time between Paris, where she moved in the most exclusive circles, and Les Rochers, her late husband's country seat in Brittany. Her daughter, to whom she was almost idolatrously devoted, married the Comte de Grignan, and Madame de Sévigné's famous letters are largely the result of her separation from this beloved child. Written in the purest French, they are lively, vivid, and highly piquant, and during the writer's lifetime attained such celebrity in Paris that they were passed around from hand to hand among Madame de Sévigné's circle of friends. She died at Grignan, Apr. 17, 1696. *See also* FRENCH LITERATURE; LETTERS.

SEVILLE or **SEVILLA**, a city of Spain, capital of the province of the same name, on the navigable Guadalquivir River. Of the old circular wall surrounding the inner city only a few gates remain. The old city, a maze of crooked streets, has well-built, two-story houses of Moorish style with fine patios and fountains, but in later years new streets and squares have been built. The cathedral, built in the 15th century, containing many treasures, ranks among the largest in existence. Nearby rises a high bell tower with 24 bells, all that remains of the Giralda mosque. The Moorish royal palace, the stock exchange, the San Telmo palace and park, the Casa de Philatos in Moorish style, the Golden Tower of 1220, and the city hall in Renaissance style are other interesting features. Besides the large tobacco factory, there are manufactures of soap, perfume, silk, pottery and musical instruments, and a large import and export trade. Est. pop. 1929, 217,924.

SEVILLE, CATHEDRAL OF, called the largest Gothic church in the world, stands in Seville, Spain, on the site where there was once a Roman temple to Venus. The present church, built between 1403 and 1507, is of Spanish Gothic architecture and has been dedicated to Santa Maria de la Sede. Later additions have somewhat marred the original purity of style, but the beauty of the interior remains magnificent. There is a central dome, rising about 120 ft., and four aisles, and a nave 150 ft. high. Famous art treasures are the 16th century Flemish stained glass windows; paintings by Murillo, Goya, Campanas, Montanes and Zurbaran; the silver shrine containing the body of St. Ferdinand and a priceless collection of art objects of the 16th, 17th, and 18th centuries in the church treasury. Murillo's painting, *The Guardian Angel*, is in the cathedral and in the baptistry,

The Vision of St. Anthony of Padua. The monument and tomb of Christopher Columbus are in the south transept, although there is some doubt as to whether the actual remains are here, many believing them to be in the Cathedral of Santo Domingo.

SÈVRES, a town in the department of Seine-et-Oise, France, on the Seine River, about 3 mi. from Paris. It is famous for its porcelain, the manufacture of which was acquired by the nation in 1759 and is still carried on. A valuable pottery museum is located here. Pop. 1931, 15,457.

SÈVRES, TREATY OF, an unrati ed treaty of peace concluded between the Allied Powers and Turkey on Aug. 10, 1920. Though signed by the Sultan at Constantinople it was repudiated by the newly established government under Kemal Pasha at Angora. The treaty deprived Turkey of her European and all of her Asiatic possessions save Anatolia. Constantinople and the Straits were to be internationalized and placed under the League of Nations, while Greece was given eastern Thrace and the region of Smyrna. Following the victories of the Turkish nationalists led by Kemal Pasha over the Greeks in Asia Minor and his occupation of Constantinople, a new treaty signed at Lausanne, July 24, 1923, superseded that of Sèvres.

SEWAGE, a by-product of the use of water supply in homes and industry. Its composition varies (a) as it is predominantly of domestic or industrial origin, and (b) with the dilution which is determined by the industries, or by whether water is extravagantly, freely or sparingly used in the community. It must be either: 1. Wash water and water-carried animal, culinary, and in some cases industrial wastes; 2. Liquid waste containing human excreta, including feces, urine, secretions from the skin, expectoration, etc., and other matter flowing in or from a house drainage; or 3. A combination of the liquid wastes conducted away from residences, business buildings, and institutions, and from industrial establishments, with such ground, surface and storm water as may be admitted to or find its way into the sewers. Sewage will be contaminated with grit, dust and other fine mineral particles, and with organic matter of animal or vegetable origin. The contaminating solids may be floating in the sewage or be in solution. For purely domestic sewage, the total solid matter will vary between 50 and 100 grams per capita per day. This will amount to from 200 to 800 parts per million of solid matter, depending on whether the sewage is diluted or strong—of the solid matter approximately 65% is represented by material in solution and the remainder is in suspension.

Because of the organic matter present, sewage is putrescible and requires special care as to disposal. *See* SEWAGE DISPOSAL.

W. W. H.

See Kinnicut, Winslow and Prett, *Sewage Disposal*, 1919.

SEWAGE, DISINFECTION OF, a form of purification by which bacteria and other organisms, which might otherwise spread disease or cause putrefaction, are destroyed. Disinfection comprises the sterilization of sewage by the use of chemicals, gen-

erally liquid CHLORINE or hypochlorides. Special apparatus applies liquid chlorine at a rate proportioned to the sewage flow. This is extensively used as a final disinfection of effluents from sewage plants and as the sole treatment of sewage where only the removal of pathogenic BACTERIA is required.

Sewage is also treated with chlorine to deodorize it, to sterilize it and to keep it from decomposing. *See also* CHLORINATION.

W. W. H.

SEWAGE DISPOSAL may be by dilution in bodies of water—the ocean, large lakes or streams—or may be on land by broad SEWAGE IRRIGATION or sub-surface IRRIGATION. Disposal of crude sewage in this way is satisfactory if no nuisance is developed, or if contamination of bodies of water is not such as to adversely affect its use by other communities or individuals either as a potable water supply or for bathing or recreation. Where the discharge of crude sewage would result in STREAM POLLUTION or other objectionable conditions, the sewage must be treated, at least to some extent, prior to disposal.

Seaside cities generally dispose of sewage by dilution. But large cities on landlocked bays and similar waters have taken precaution in the location of outlets and some have had to adopt means of partial SEWAGE TREATMENT, as screening at Los Angeles, and extensive purification works for New York City under the plan of 1930. St. Louis, New Orleans and other cities on the lower Mississippi continue disposal by dilution in the river.

W. W. H.

SEWAGE FILTERS, masses of crushed stone enclosed in watertight basins to which the SEWAGE is intermittently applied, aeration taking place in the interval; or "trickling filters" in which the sewage is sprayed from nozzles more or less continuously, air being permitted to circulate through the bed at the same time. By either method the organisms (*see* SEWAGE OXIDATION; *also* BACTERIA) develop as a coating on the stones which absorb the sewage, reducing and oxidizing it. The process is sometimes aided by the presence also of other micro-organisms. In this process the oxidized solids tend to build up the coating. From time to time this sloughs away as a more or less stable suspended matter that requires final sedimentation of the "effluent" to complete the process.

Sewage sand filters serve the same general purpose as trickling filters. They consist of beds of relatively coarse sand overlaying gravel and having an under-drainage system. The sewage is passed by gravity through the sand beds, where filtration and oxidation take place. Sand filters can be used for sewage containing only a small amount of suspended solids, but may generally be used as a final process following trickling filters or the ACTIVATED SLUDGE PROCESS where an unusually good effluent is required.

W. W. H.

SEWAGE IRRIGATION has for its purpose the sanitary disposal of sewage and the fertilization of soil. Sewage, either raw or treated, is applied to land in the same manner as water. All crops grown under irrigation can be produced with sewage irrigation, but it is

not permissible to irrigate with sewage, fruits or vegetables eaten raw. Sewage irrigation frequently affords an economical and sanitary method of disposal of sewage from institutions and small towns. It is more extensively used abroad than in the United States and a number of large cities in Europe dispose of their sewage on farms. *See also* IRRIGATION.

S. H. M.

SEWAGE OXIDATION. In the process of sewage purification, much of the fine suspended organic matter cannot be removed in the SETTLING or SEDIMENTATION TANKS. This material together with a considerable part of the dissolved solids can be effectively treated by having it oxidized by *bio-chemical* processes, which require contact of the sewage with bacterial organisms in the presence of oxygen.

Of the methods for the bio-chemical oxidation of sewage, treatment in contact beds is little used at this time except for small institutions, but nearly all plants involve either the trickling filter (*see* SEWAGE FILTERS) or the ACTIVATED SLUDGE PROCESS. The objections to the trickling filter are the great area required for the plant, relatively high first cost of construction, the odor produced through the spraying of the sewage and occasionally serious plagues of insects. On the other hand the activated sludge process requires only a small site and can be conducted without the production of appreciable odor, though operating costs are much higher.

W. W. H.

SEWAGE SCREENING is resorted to in SEWAGE TREATMENT as a method of removing the coarser particles of solid matter. Bar screens on racks with openings one inch or more in width are used as a preliminary step, as is also fine screening through mesh or slots of one-fourth inch or smaller. Both may be indicated as the treatment in advance of disposal by "dilution." Fine screens are generally movable screens mechanically cleaned. They may be disc screens or of the belt or drum type.

W. W. H.

SEWAGE TREATMENT, a process to which SEWAGE is subjected in order to remove or alter its objectionable constituents so as to render it less offensive or less dangerous. In the best cases it includes the removal or alteration to an "earthly" condition of all putrescible, and the removal of all infectious or offensive, matter. Sewage treatment is required where the disposal of crude sewage by dilution or irrigation would create offense or danger of infection. *See also* STREAM POLLUTION; SEWAGE IRRIGATION.

Treatment may mean only disinfection, generally by application of CHLORINE, either as liquid or as hypochlorite, but generally implies the removal of part of the putrescible organic matter, and its sterilization after "digestion" and SEWAGE OXIDATION. It may involve improvement in character of sewage through the removal of coarse solids by sedimentation, or of fine suspended solids and some dissolved solids by settling after bio-chemical oxidation. The removal of putrescible matter as estimated for New York City conditions is, by fine screening, 5%; by sedimentation, 33½%; and by the ACTIVATED SLUDGE PROCESS, 85%.

The equipment used in sewage treatment involves mechanisms for the removal of coarse solids, **SETTLING TANKS**, Imhoff tanks, septic tanks for the settling out of finer solids, contact beds, **SEWAGE FILTERS**, sand filters, aeration apparatus for the oxidation and removal of colloidal and dissolved solids, as in the activated sludge process, and **SLUDGE DIGESTION** tanks for the purification of settled solids.

Sewage treatment has been going through stages of crude experiment and rule of thumb operation during the past 50 years, but is now on a technical basis. The larger municipalities and certain public experiment stations are working out processes which will probably transform the typical treatment plant from an unsightly and uncertain installation into a definite industry, positively controlled and free from serious nuisance. The biggest factors will be the development of mechanical equipment in settling tanks, the controlled operation of sludge digestion tanks to the best conditions, and the further application of the activated sludge process. *See also* **SEWAGE DISPOSAL**.

The cost for a city of 250,000 population is, for an activated sludge plant, \$1,750,000; and for a trickling filter plant, \$2,500,000. The annual charges would be for aeration, \$244,800 and for the trickling filter, \$241,300. For a city of 50,000 population the cost of the activated sludge plant is \$340,000 and for a trickling filter plant, \$390,000; the annual cost of operation for the activated sludge plant is \$58,700 and for the filter plant, \$40,000. Generally, the annual cost for sewage treatment will range from slightly less than \$1.00 to possibly \$2.00 per capita. W. W. H.

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SEWALL, SAMUEL (1652-1730), American jurist and diarist, was born at Bishopstoke, England, Mar. 28, 1652. Brought to Newbury, New England, in 1661, he graduated from Harvard and studied divinity. Deciding, however, upon a secular career, he managed, in Boston, from 1681-84, the first licensed printing press in the country, and held several public offices. For his part in condemning 19 persons for witchcraft, Sewall later made public confession of remorse. He became successively Probate Judge for Suffolk County, Judge of the Superior Court; and, from 1718-28, Chief Justice of the Superior Court. His diary, an intimate account of his times, is of great value. He died at Boston, Mass., Jan. 1, 1730.

SEWANEE, a village of southern Tennessee, in Franklin Co., situated on a plateau 2,000 ft. above sea level, 13 mi. east of Winchester, Tenn. The Nashville, Chattanooga and St. Louis railroad affords transportation. Sewanee is the seat of the University of the South, founded in 1857, and the Sewanee Military Academy. Timber-cutting and coal-mining are the chief interests of the vicinity. Pop. 1930, 1,293.

SEWARD, WILLIAM HENRY (1801-72), American statesman, was born in Florida, N.Y., May 16, 1801. He graduated from Union College in 1820, was admitted to the bar in Utica, N.Y. in 1822, and began his legal practice in Auburn, N.Y. As a mem-

ber of the Anti-Masonic party he served in the state senate, 1830-34. In 1834 as the Whig gubernatorial nominee, he was defeated by William L. Marcy. From 1839-43 he was governor of New York and was recognized as the leader of the anti-slavery Whigs, who favored political action to curb any extension of slavery.

Seward resumed his law practice in 1843 but re-entered politics in 1849 when he was elected to the U.S. Senate. He opposed the Compromise of 1850, asserting the existence of a "higher law" than the Constitution. In 1854 he was one of the leaders of the unsuccessful effort to prevent the passage of the Kansas-Nebraska Act, 1854. With the formation of the Republican party in 1854 he worked to assemble the anti-slavery elements of the Senate and the House within the new organization. His coolness toward the Republican presidential nomination of 1856 resulted in the selection of Fremont, and in 1860 his active solicitation of the nomination failed because of the greater popularity of Lincoln. He became Secretary of State in Lincoln's cabinet and after the accession of Andrew Johnson upon Lincoln's assassination he continued in the office, serving from 1861-69. At first he showed an officious desire to dictate Lincoln's policies but he afterward became a loyal supporter and aide of the martyr President.

The office of Secretary of State required the utmost skill and delicacy in the handling of its affairs during the Civil War. European nations, particularly France and England, were seriously affected by the American war and it was important to ultimate Union success that they be prevented from recognizing the rebellious Southern states. In this task Seward with the aid of able foreign ministers was successful although he was unsuccessful in stopping the furnishing of supplies to the Confederates. At the time of Lincoln's assassination Seward was severely stabbed by an assailant as he lay ill in bed. He recovered and continuing in the Cabinet was a supporter of Andrew Johnson. At his insistence, the French troops were withdrawn from Mexico in 1866-67. Seward negotiated the treaty whereby the United States purchased Alaska from Russia. The region at the time was popularly dubbed "Seward's folly" and "Seward's ice-box." He also negotiated a treaty for the purchase of the Danish West Indian Islands which failed of ratification in the Senate. He died in Auburn, N.Y., Oct. 10, 1872. S. McK.

BIBLIOGRAPHY.—F. Bancroft, *Life of William H. Seward*, 2 vols., 1900.

SEWARD, a seaport town of southern Alaska, in the third judicial division, situated on Resurrection bay, an inlet of the gulf of Alaska, about 1,800 mi. northwest of Seattle, Wash. It is served by steamships and is the terminus of the Alaska Railroad. It is a distributing center and market for the Aleutian islands, the Alaska peninsula and much of the Cook's Inlet section. Seward has a cold storage plant, commercial fisheries, and fur farms. Jesse Lee Home for native children is located here. Pop. 1920, 652; 1930, 835.

SEWARD WHIGS, followers of William H. Seward, eminent New York State Whig and elected United States Senator in 1848, who voted the regular Whig ticket in 1848 despite the failure of the party to commit itself on the slavery issue, but who were themselves definitely committed to the antislavery cause. They ultimately became Republicans.

SEWERAGE, a collecting system of pipes and conduits—with ditches, channels and other appurtenances—intended to receive SEWAGE from places of habitation and remove it to a point of disposal. It includes PLUMBING, house connection sewers, street sewers, outlet sewers, and sometimes involves treatment plants (*see* SEWAGE TREATMENT), and final discharge sewers. The term is more commonly used for systems conveying sewage but is also applied to "storm sewers" intended to convey away storm water, surface water, street wash and other drainage. Although there are evidences of elaborate sewerage systems in the palace ruins in Crete, and large sewers or drains existed in Rome before the Christian Era, public sewerage as we now know it hardly existed before 1800, and in the modern sense it was first evidenced in the Hamburg, Germany, system in 1843 and in the Brooklyn plan of 1857.

Sanitary Sewers handle the ordinary flow of domestic and industrial sewage. They generally consist of a system of clay or concrete pipes. Storm sewers should have capacities determined by the rate of slope toward the outlet and the roughness of their interior surface. Such sewers are proportioned to the area drained and of the rates of rainfall. They are rarely designed for the heaviest rainfall expected to occur, but for a somewhat less rate, a study of the economic factors indicates the propriety of permitting an overcharge at long intervals. Before the rates of rainfall are applied to sewer design they are modified by "runoff" coefficients which depend on the character of the soil and its coverage, only small percentages of the rainfall actually running off from granular soils in undisturbed or cultivated condition, while nearly the whole of the rainfall on paved surfaces and roofs enters the sewer system. Storm or combined sewers for small urban areas may have capacities equivalent to 4.0 cubic feet per second per acre drained, while for large suburban districts the factor may be as small as one half cubic foot per second.

Combined sewers are designed very much as are storm sewers but are arranged so that sewage also is carried in them. As the maximum weather sewage is only 2 or 3% of the maximum flow of storm water, combined sewers are normally nearly empty.

Sewers are primary essentials to community sanitation, though storm sewers are of less importance and must be economically justified. Land otherwise occupied by natural water courses may be reclaimed by storm sewers. Combined sewers are generally economical wherever storm sewers are justified and where the sewage can be disposed of through dilution. Where the sewage must be taken to disposal works, separate storm and sanitary sewers are often prefer-

able. Storm sewerage may require conduits of extremely large size; in some instances these may be as large as 25 feet in diameter.

Sanitary sewerage generally cost from \$300 to \$500 per gross acre sewered, and combined sewers for more complete systems as much as \$1,500 to \$2,000 an acre.

W. W. H.

SEWERS of small size are constructed of pipes manufactured in short sections and joined as they are laid in the ground. The materials for such pipes are generally vitrified clay, or concrete either with or without metal reinforcement. Such pipes are generally manufactured in sizes of from three to six inches in diameter, when used for house connections, and of 8 to 36 inches in diameter when laid under streets as part of a "system." Such pipes are made in several different thicknesses and strengths.

Larger sewers are constructed of brick masonry or of interlocking hollow tile blocks, which, under heavy fills, are sometimes strengthened with a concrete backing. Concrete pipe with heavy steel reinforcement is also used in larger sewers. Brick, block and reinforced concrete pipe are employed in sewers from 2½ to 10 feet in diameter. Very large sewers are generally constructed of reinforced concrete built in place.

The thickness of sewer walls may vary from one inch for a 12 inch pipe to 13 inches for a six foot brick sewer and to as much as two or three feet for concrete sewers of 20 or 25 feet diameter. Expected stresses from earth loads on each part of these large concrete sewers must be carefully determined as must the effect of structures and vehicles on the surface.

Where not required to serve abutting property, small as well as "outlet" sewers are sometimes built as deep tunnels. St. Louis, Mo., has about 12 miles of 5 to 16 foot sewers built as tunnels through limestone rock 50 to 120 feet below the surface. W. W. H.

BIBLIOGRAPHY.—L. Metcalf and H. P. Eddy, *American Sewage Practice*, 1922.

SEWER VENTILATION is made necessary in SEWERS having flat grades that permit deposits to occur and in which the slow flow of SEWAGE permits putrefaction to take place. This condition is accelerated by high temperatures, and increases with time, but where free movement of air can be secured, little odor results. Perforated openings in sewer manholes, ventilation through inlets on combined sewers, and through the vents of the traps on house sewers minimizes the nuisance. Recently the importance of ventilation has been emphasized because of the presence in sewers of inflammable gases from gasoline or naphtha escaping through house and industrial connections. Ordinances of cities generally prohibit the discharge of inflammable wastes, but enforcement is difficult. Serious explosions in sewers have occurred from ignition of such gas as well as of METHANE and other gases of decomposition.

W. W. H.

SEWICKLEY, a borough and residential suburb, in Allegheny Co., southwestern Pennsylvania, situated on the Ohio River, 12 mi. northeast of Pittsburgh. It is served by river craft and the Pennsyl-

vania Railroad. Sewickley is an agricultural and coal-mining region, surrounded by beautiful scenery. The borough was incorporated in 1853. Pop. 1920, 4,955; 1930, 5,599.

SEWING MACHINES. Both manual and electrically operated sewing machines are divided into two general types: those sewing with double, or "lock," stitch and those producing a single, or "chain," stitch. Double-stitch models are further divided into vibrating and rotary types. In general, the double stitch machines, the more usual type, comprise a reciprocating member which punches a threaded needle through the material, a threaded "shuttle" which forms the stitch and a feeder which moves the material ahead after the stitch is made; together with the necessary driving members and tension regulating mechanisms. The earlier power machines were identical with the manual type except that the treadle was replaced by an electric motor. In the later models the motor and machine are a single unit. The motor of power machines is controlled by a foot pedal or knee lever. *See also* HOWE, ELIAS. L. WR.

SEX, a term which sums up the characteristics, physical and psychic, which distinguish the male and the female. Where in amphigonic reproduction there exists a division of labor between the two reproductive elements such that the one is large and bulky, as the egg cell of the female serving as a storehouse of formative material, and the other is small and motile, as the sperm cell of the male, ensuring the meeting and fusion, true sexual reproduction exists. Prevalingly, different individuals, male and female, produce the distinctive reproductive elements. In certain of the lower animals the same individual forms both egg and sperm cells. This is termed hermaphroditism and exhibits a number of forms. Hermaphroditism also occurs among the lower plants, but in the vegetable kingdom sex distinction is usually complicated through the existence of alternate sexual and asexual generations with the latter greatly predominant in the higher plants.

While the essential difference between the sexes is the production of egg cells and sperm cells respectively, a number of distinctive accessory structures exist which are necessary for the reproductive processes, i.e., primary sexual characters and the reproductive system. Often, also, sex differences manifest themselves in other portions of the body as secondary sexual characters. These include varied and often variable expressions of sexual differences, such as size, form, haircoat and plumage. Not infrequently, however, no obvious secondary sexual differences are distinguishable.

The causation or determination of sex and sex differences is not fully understood. It seems, however, clearly established that in most animals including man the sex of the offspring is determined at the time of the fertilization of the egg, that is at the beginning of the individual life cycle. Usually the sex is determined through the sperm cells which are then of two kinds. Occasionally, as in butterflies, moths

or birds, it is the egg cell which carries the sex-determining factors. In the typical case two extra or sex chromosomes (XX) are present in the female with but one such chromosome (X) in the male. In the atypical case, the sperm cell carries the extra chromosome. In either case the sex-determining germ cells possess in their nuclei chromosomal differences which are linked with the sex of the offspring. How such additional nuclear material effects the determination of sex is unknown. There is however certain evidence that it is through quantitative rather than qualitative differences in the development that the sex is determined. It has been suggested that it is through the metabolism that such quantitative differences between the sexes is expressed. The production of egg cells represents an energy-storing metabolism; the sperm cells an energy-expending metabolism. In many animals, e.g., man, pig, common fowl and many fish, frequent appearance of intersexual individuals reveals how slight a separation sometimes exists between maleness and femaleness.

In man and the higher animals at least, internal secretions called hormones from the reproductive glands in correlation with other endocrine glands are factors in the development of sexual characters.

B. F. K.

SEX, PSYCHOLOGY OF, a science stressing the differences between the sexes that give rise to conflicts. It studies types of adjustment and behavior patterns in the relation between the sexes. Much emphasis is placed on normal functioning, and the importance of the sex life for men and women is not minimized.

There are psychological as well as biological differences between the sexes. Woman is more anabolic, man more katabolic; woman tends more to type, man to variation; woman is more personal in her outlook on life, man more impersonal. There are differences of temperament; woman is apt to be more emotional than man. Added to these differences are differences in training, making for different interests. It has been said that woman's chief interest is her love interest, while for man this interest is only one among many. Man's contacts broaden his horizon while woman's outlook is narrowed by her occupation in the home. To what extent these differences are real or due only to custom is still to be determined. Undoubtedly the feminist movement is breaking down the old barriers; probably, however, it is also raising new ones.

SEXAGESIMAL FRACTIONS, a kind of fractions inherited from the Greek astronomers of the second century B.C., and suggested to them but not elaborated by the Babylonians. It is illustrated by our system of angle measure, as in $5^{\circ}30'45''$, which means $5^{\circ} + \frac{30^{\circ}}{60} + \frac{45^{\circ}}{3600}$, or in decimal fractions, 5.5125. So conservative are we, however, that we still continue to use sexagesimals in angle measure instead of the much easier decimal equivalents. We also use sexagesimals in the measure of time, following an ancient

method employed by the priests and astrologers, as when we write 2 hr. 15 min. 9 sec. instead of 2.25 hr., approximately, or 2.2525 hr. precisely. The name is derived from the Latin *sexagesimus*, sixtieth. See FRACTIONS.

SEX CHARACTERS (In Man). Mankind may be classified not only into types and races but also into a fundamental dichotomy, male and female. The sexual dimorphism of man is a characteristic shared with a great many other living creatures. Sex is probably determined when the ovum is impregnated; but not until the end of the second month of uterine development is it possible to recognize the difference between male and female. From then on in the development of the individual sex differences become increasingly prominent. It is a common observation that men are taller, heavier and stronger than women; but this sexual distinction is carried further into almost every physical trait. Havelock Ellis has listed the innumerable ways in which the male differs from the female. Man has a larger head, a heavier brain, a smaller and narrower pelvis, a greater muscular development, different proportions of the body, a characteristic distribution of body hair, and a deeper voice. This list might be tediously expanded but it is enough to indicate the deep-seated differences which exist between the sexes. The sex characters are sometimes divided into primary and secondary. To the primary sex characters belong the genitalia and reproductive organs. Such sex characters as the mammary glands would be classified as secondary.

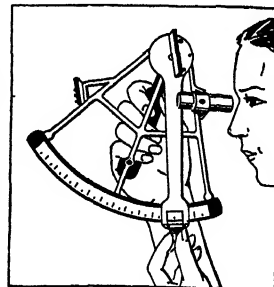
In recent years it has been discovered that the sex glands are both germinative and glandular in function. It is to these glands or gonads that sex differences are attributable. For the most part the sex characters of children grow in a slow, almost imperceptible fashion. But at puberty a striking change becomes manifest. Probably as the result of the increased activity of the gonads the sex characters in boys about 14-16 and in girls somewhat earlier become more decisive and significant. In boys the beard appears; the voice breaks; the face, jaw and neck become heavier and more massive, and the frame fills out. In girls menstruation commences, the breasts develop and the pelvis becomes capacious. The female remains more infantile in her characteristics. In eunuchs the generalized infantile, and consequently feminine, traits persist since the specific action of the secretions of the gonads has been eliminated. H. L. S.

SEXTANS (gen. *Sextantis*), the sextant, a small unimportant constellation between Leo and Hydra. See STAR: map.

SEXTANT, an optical instrument, having a fixed mirror and a mirror attached to a movable arm that extends to a graduated arc, which is used for finding the position of a ship or airplane. By moving the arm, the reflection of one object seen in the fixed mirror may be made to coincide with another object seen through an opening above the fixed mirror. The angle formed by two objects, with the observer at the vertex, may be read on the graduated arc. It may be

used in measuring both vertical and horizontal angles, particularly in making observations while on a moving ship or an airplane where the motion would make other instruments useless.

This makes the sextant one of the most important instruments in all forms of navigation. It is also used in surveying and is especially valuable in work along shores where the observer finds it necessary to be in a boat. The sextant was invented by an American, Thomas Godfrey, in 1730. See NAVIGATION.



SEXTON, a Middle English corruption of SACRISTAN, an under-officer or janitor of a church, who has care of the building and its furniture, vestments, utensils and the like, rings the bell, superintends burials and, in some large city churches, is also an undertaker. The sexton is also a grave-digger.

SEXUAL SELECTION, a process of evolution originally postulated by CHARLES DARWIN to account for the genesis of secondary sexual characters. Some adornments of the male, such as the bright colors of many male birds, make their owners conspicuous and expose them to the attacks of enemies. In the struggle for existence it might be assumed that the conspicuous bird would not be able to survive. Darwin conceived that the bright colors were attractive to the females and conferred upon their owners a decided advantage in securing mates. Similarly organs for the pursuit or capture of mates, or for combating rivals or for alluring mates would bring success to their owners and would be gradually improved in the course of time.

There is no doubt that many secondary sexual characters have a decided use. In fish which breed in isolated pairs the males are often brightly colored and the gaudy tones serve to warn rivals away from the selected territory. Similarly in lizards the bright colors of the male are bluffing devices which are exposed to the fullest extent before possible rivals. Experiments have shown that the colors serve to advertise the presence of a male ready to fight. The females are given no opportunity to make a selection between possible rivals and hence sexual selection in the original Darwinian sense does not exist among lizards. Where odors play a large part in sex attraction, as in snakes and mammals, there is no need for male adornment and such groups rarely show a sexual difference in color.

Since the proportion of the sexes is nearly equal in nature and few females do not succeed in breeding it has been objected that sexual selection is merely a form of natural selection in that it merely insures an even distribution of males in the community. For example, in birds the call of the male on the breeding grounds serves to identify his territory which he will defend against all rivals. The breeding call, a dis-

tinctive secondary sex character, serves to insure the isolation of males in different territories. This has the advantage of giving an adequate feeding range to each pair of birds when they are rearing their broods at a later date.

Sexual selection in this modified sense has aided the evolution of secondary sexual characters. It was assumed by some naturalists such as A. R. Wallace that secondary sexual characters were produced by male vigor. Recent genetic studies have clearly demonstrated that secondary sexual characters owe their origin to gene mutation and gene inheritance although hormones may modify the result. (See ORGANIC EVOLUTION.) The type of courtship found within a group has favored the survival of those mutations which facilitate this particular type. Hence the mode of courtship rather than female choice has shaped the form of animals and has given bright colors to certain groups.

G. K. N.

SEYCHELLES, a British archipelago in the Indian Ocean, consisting, with its dependencies, of 101 islets comprising a total area of 156 sq. mi. The principal island is Mahé, which covers one-third of the total area. Of the others the more important ones are Praslin, Silhouette, La Digue, Curieuse and Félicité. The surface of Mahé and Praslin is mountainous, with hills rising to approximately 3,000 ft. above sea level. The products include copra, cinnamon oil, guano, rubber, tortoise-shell and phosphate. Cattle, sheep and goats are reared in small numbers. Port Victoria, on Mahe island, is the capital and largest town. Est. pop. 1929, 27,588.

SEYMOUR, HORATIO (1810-86), American statesman, was born at Pompey Hill, Onondaga Co., N.Y., May 31, 1810. He was educated at Geneva College (now Hobart) which he attended for two years, and at Captain Partridge's Military Academy in Middletown, Conn., from which he graduated. He studied law in Utica, N.Y., and in 1832 he was admitted to the bar, but never practiced since his inheritance of a large estate relieved him of the need of earning a livelihood.

Governor Marcy, at the recommendation of President Van Buren, appointed Seymour his military secretary, 1837-39. In 1841 he was elected as a Democrat to the state assembly and the following year was elected mayor of Utica. In 1843 he was defeated for the mayoralty but the same year was re-elected to the assembly serving until 1845. Seymour as the Democratic gubernatorial candidate was defeated by a few hundred votes in 1850 by his Whig opponent, but he was successfully elected governor of New York state in 1852. During his term he vetoed a state prohibition bill and in 1854 he was defeated by the coalition candidate of the Whigs and the temperance advocates.

With the outbreak of the Civil War Seymour urged the loyal support of the government at Washington and he deplored the rebellion as a wicked uprising against a good government. He was once more elected governor in 1862, and although he reiterated

his support of the Union cause, he protested against what he characterized as the needless suppression of the press and the arbitrary arrest of persons by the national government. He objected to the inequities of the Federal draft law and unavailingly sought a postponement of its operations. With the outbreak of the draft riots in New York City July 1863, he hurried to the city and with tact with the mob and firmness with the troops, he quieted the tumult in less than a week. In 1864 Seymour, again a candidate for the governorship, was defeated by his Republican opponent. He was the Democratic presidential nominee in 1868, when Grant defeated him. Seymour retired to his palatial farm near Utica and refused thereafter to be a candidate for any public office. There he died, Feb. 12, 1886.

SEYMOUR, a city in southern Indiana, in Jackson Co., situated 59 mi. south of Indianapolis, and served by bus lines and three railroads. The city has many industrial plants including flour, lumber and woolen mills, leather belt, shirt, shoe and furniture factories. Seymour was laid out about 1850 and chartered as a city in 1867. Several miles east of the city is Muscatatuck State Park. Pop. 1920, 7,348; 1930, 7,508.

SFAX, a fortified seaport of Tunis, Africa, on the Gulf of Quabes, occupying the site of what was once a Roman settlement. Like many other African towns, Sfax is composed of two parts—one inhabited by the Arabians and the other by the Europeans. Railways put it in direct communication with Gafsa, which is rich in phosphate deposits. There is a good harbor and a lively trade is carried on, chiefly in fish, phosphates, olive oil, almonds, sponges, silks, cottons and woollens. Pop. 1931, Europeans, 27,723.

SGANARELLE, a comic character who appears under different guises in the following plays by MOLIÈRE: *LE MÉDICIN MALGRÉ LUI*, *l'École des Maris*, *l'Amour Médecin*, *Mariage Forcé*, *Le Festin de Pierre* and *Le Cocu Imaginaire*. He is sometimes young, sometimes old, and his character shifts from that of villain to hero.

SHABBATAI ZEBI (1626-76), Jewish pseudo-Messiah, who was born in Smyrna on July 23, 1626. At an early age Shabbatai showed a keen interest in the mysteries of the Cabala and began the practice of some of its ascetic teachings and inclined to a life of solitude and ecstasy. At the age of twenty-two he boldly revealed himself to a small group of followers as the expected messiah of his people. Thereupon he and his followers were banished from Smyrna and later also from Salonica, but subsequently sojourned in Cairo, Egypt, for two years (1660-62) prior to his arrival in Jerusalem. Finding the rabbis in Jerusalem indifferent to his claims, he returned to Smyrna his native city where in 1665 he had himself proclaimed as the expected Messiah of the Jews. His fame now spread far and wide and he gained many followers in various communities. When in 1666 Shabbatai came to Constantinople he was at once arrested and cast into prison in chains; two months later he was transferred to the state

prison in the castle of Abydos. From the prison walls he nevertheless managed to direct the affairs of the messianic movement which he inaugurated.

Shabbatai's activities were reported to the Sultan Mohammed IV as prompted by treasonable desire and he was transferred to Adrianople where he was advised that in order to save his life he embrace Mohammedanism. On September 6, 1666, he was formally converted to Islam. Meanwhile Shabbatai continued his plots and secretly played a double game. At times he would assume the role of a pious Mohammedan and revile Judaism; at others he would associate with Jews as one of their own faith. Thus in March 1668 he or one of his followers broadcast a work addressed to the Jews in which fantastic claims were made: that he was the Redeemer and that in spite of his conversion, he hoped to bring to Judaism many followers of Islam, while to the Sultan he gave assurance of his intention to accomplish the reverse. The result of this dual plot was the formation of a Judeo-Turkish sect, the followers of which placed implicit faith in him. Soon, however, his dual acts displeased the Turkish authorities and he was banished to Dulcigno, a small place in Albania where, on September 30, 1676, he died in loneliness and obscurity. J. BL.

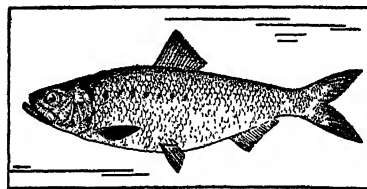
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SHACKLETON, SIR ERNEST HENRY (1874-1922), British explorer, was born at Kilkee, Ireland, Feb. 15, 1874. After studying at Dulwich College, and serving in the merchant marine, he became an officer in the Royal Naval Reserve. In 1901-04 he was third lieutenant in Scott's expedition to the South Pole and in 1907 financed and commanded an expedition which came within 97 miles of the South Pole and was the first to reach the South Magnetic Pole. Between 1914 and 1916, he headed an expedition which crossed the continent of Antarctica from Coats Land to McMurdo Sound. Shackleton was knighted in 1909 and made an officer of the Legion of Honor. He was awarded the special medal of the Royal Geographic Society, and awards from the geographical societies of Denmark, Belgium, France, Italy, America, Russia, Paris, and Antwerp. He is the author of *Heart of the Antarctic*, and *South*. He died at sea off South Georgia Island, Jan. 5, 1922.

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SHAD (*Alosa sapidissima*), an important food fish of the HERRING family (*Clupeidae*). It is found on the Atlantic coast from the Gulf of St. Lawrence to Florida, ascending the larger rivers in great numbers in early spring to spawn; it is abundant as an introduced species on the Pacific coast from Monterey northward. The shad has a relatively deep body, bluish above, silvery on the sides and below, sometimes with dark blotches on the sides. It attains an average length of nearly 2 ft. and a weight of 4 lbs. Although containing numerous small bones the flesh of the shad possesses a fine delicate flavor. When crowded in the lower parts of rivers in spring shad

are caught in immense numbers. As it feeds chiefly on minute plants and animals, the shad is taken chiefly by gill nets. To prevent its extinction the U.S. Bureau of Fisheries annually restocks many



streams with young fish. In 1929 the catch in United States waters was 17,234,000 lbs., valued at \$2,468,000.

SHADBUSH, a name given to the SERVICE BERRY or June berry, a small shrubby tree of the rose family blossoming in early spring at about the time the shad ascend the rivers.

SHADDOCK, a name applied, especially in the West Indies, to varieties of the pummelo with large pear-shaped fruits; it is allied to GRAPEFRUIT.

SHADOW, the region which LIGHT from a given source fails to illuminate because of an obstruction. The boundary line between light and shadow is not sharply defined because of DIFFRACTION, a wave phenomenon (see WAVE MECHANICS). The boundary of the geometrical shadow is the line which would be formed if light were propagated rectilinearly.

SHADOW OF THE EARTH, a meteorological phenomenon observable upon any clear evening immediately after sunset, which appears as a broad band, bluish-black in color. This rises in the east in the same measure that the sun sinks more and more below the western horizon. It is actually the shadow of the earth cast upon the air.

SHADWELL, THOMAS (1642-92), English dramatist, was born at Stanton Hall, Norfolk, in 1642. He was educated at Cambridge, and studied law, but soon turned to writing. A number of his plays are adaptations from the French, or written in frank imitation of BEN JONSON. When his friend Dryden joined the court party, Shadwell attacked him vigorously. Dryden responded with such effect that his antagonist lives, in large part, as the MacFlecknoe and Og of the retaliating satires. However, when the Whigs returned to power, in 1688, Shadwell succeeded Dryden as Poet Laureate. Among his plays are *Epsom Wells* and *The Squire of Alsatia*. He died at Chelsea, Nov. 19, 1692.

SHAFT, in mining, a vertical or inclined excavation of small cross-section and relatively great depth. Except where the topography permits the driving of tunnels, shafts serve as entries to a mine. Shaft cross-sections are circular, elliptical or rectangular, usually the latter in metal mining. The shaft is divided into compartments, usually two for hoisting, and one or more to accommodate ladders, pump and compressed-air pipes and electric cables. The top part of the shaft is known as the collar. Timber is the usual

shaft support in metal mining. Shaft stations, where cage and skip loading and mine-car switching are done, are provided at each level. *See also* MINING, METAL; MINING, COAL.

SHAFT, DRIVING. Power distribution in factories was formerly done through driving or line shafting. A steam engine drove the long line shaft; and pulleys, attached at the desired intervals, transmitted power to various machines throughout the shop. A smaller shaft, driven from the main shaft, frequently supplied power to a small group of machines.

SHAFTESBURY, ANTHONY ASHLEY COOPER, 1st Earl of (1621-83), English statesman, was born at Wimborne St. Giles, Dorset, July 22, 1621. In public life he was first an adherent of the king, then went over to the parliament, a change, as he explained, due to his Protestant principles. After the execution of Charles I, he supported Cromwell but later opposed him, and favored a restoration. He was, in fact, one of the commissioners sent to Breda to invite Charles Stuart to return, and when the king was crowned (1661), Cooper was made a baron and chancellor of the exchequer. He was interested in the colonization of America and was one of a small group to obtain the grant of Carolina in 1663. Locke's interesting plan of government for the colony is supposed to have been written at his suggestion. Cooper was created Earl of Shaftesbury on his appointment as lord chancellor (1672), but because of his unsympathetic attitude toward the High Church party and his severity toward the Roman Catholics lost favor with the king and was dismissed in 1673. From then on, he was the leader of the parliamentary opposition to the court, was arrested on the charge of treason but acquitted, but his share in the Monmouth conspiracy later was plainly treasonable and he fled to Holland where he died at Amsterdam, Jan. 21, 1683.

SHAFTESBURY, ANTHONY ASHLEY COOPER, 3rd Earl of (1671-1713), English writer, was born at Exeter House, London, Feb. 26, 1671, a grandson of the 1st Earl of Shaftesbury. He went to Winchester School but left at the end of three years to travel on the Continent and did not return to England until 1689. For a time he led a life devoted to study, then entered Parliament from which he had to retire because of ill health. When he succeeded to his father's title in 1700, he took his seat as a peer, and might have distinguished himself had not his strength given way once more. He devoted himself to writing treatises which were later to appear in three volumes called *Characteristics of Men, Manners, Opinions and Times*. In 1711 he went to Italy, and died at Naples, Feb. 4, 1713. Shaftesbury was kindly, shy, somewhat melancholy and ready to help others, particularly struggling students. He wrote on ethics, aesthetics and religion, in an affected style that CHARLES LAMB has called "genteel." Shaftesbury exerted an influence on sentimental movement in literature and translations of his works appeared in France (1769), and later in Germany.

Diderot, Voltaire, Leibnitz and Lessing were among his admirers. *See also* SENTIMENTALISM.

SHAFT PLUMBING is one of the most exacting pieces of work in surveying a mine, and is that of carrying the direction of a line down a narrow vertical shaft by means of two plumb lines. The swinging of the wires is "damped" by allowing the bobs to rest in pails of water or oil. The short line established by the wires is then extended into the workings of the mine by means of a TRANSIT.

SHAH, a title applied in English to the ruler of Persia. In the Persian language Shah denotes the ruler of a land in the capacity of either a sovereign or vassal; the monarch bears the title Padishah.

SHAHAN, THOMAS JOSEPH (1857-), American Catholic bishop, was born in Manchester, N.H., Sept. 11, 1857, and studied at Montreal College and the American College in Rome. After being ordained a Catholic priest in 1882, he served as chancellor and secretary of the diocese of Hartford until 1888, and in 1889-91 was a student of history at the University of Berlin. In 1891 he became associated with the Catholic University of America, Washington, D.C., where he was professor of church history and patrology until 1909, when he was made rector. The same year he was created domestic prelate of the pontifical court, Rome, with the rank of monsignor. In 1914 Shahan was consecrated titular bishop of Germanicopolis. He resigned as rector of the Catholic University of America in 1928 and that year was assistant at the pontifical throne. His writings include *The Beginnings of Christianity*, 1903, *The Middle Ages*, 1904, and *St. Patrick in History*, 1905.

SHAHAPTIN, an important North American Indian linguistic family, the tribes belonging to which occupied in historic times what are now southwestern Idaho, southeastern Washington and northeastern Oregon. Previously their territory had extended from the Rocky Mountains to the Cascade Range and from the Yakima River basin to the Blue Mountains of Oregon. Shahaptian villages extended along the Columbia River to the Dalles. The principal dialectic and tribal divisions of this stock are the Klickitat, Nez Percé, Palooos, Umatilla, Wallawalla and Yakima. Culturally the tribes of this stock were fairly homogeneous. The village was the unit of organization, the local chiefs were the principal authorities, and the chief food was the salmon, although game, roots and berries had their place in the dietary. Agriculture was unknown.

SHAKERS, or the United Society of Believers, originated first in England, about the middle of the 18th century, when Jane Wardley, of Bolton, began to exhort her Quaker neighbors. In their early meetings, because their bodies were strongly moved by the emotion of their experiences, they were derisively called Shaking Quakers. The chief belief of the pioneers was that "the root of evil in the world was the uncontrolled, undirected use of the sexual relation;" so they preached purity by abstinence and self-control. Their other distinctive doctrines are the

absolute equality of the sexes, virgin purity, non-resistance and the community of goods. Conditions of membership are: desire to lead a pure life, freedom from debt and freedom from marital bonds. The plain preaching of these truths brought frequent persecution from the beginning. Ann Lee, or Mother Ann, one of their earliest leaders, emigrated to America in 1774, and the period of their greatest missionary activity in America, was from 1792 to 1835, when societies were planted in Kentucky, Ohio, Indiana and the eastern states. Shakers early adopted a form of spiritualism and believed in the intercourse of spirits both in and out of the body. The present decline in membership is calmly accepted as the fulfillment of prophecy, preceding better days.

SHAKESPEARE, WILLIAM (1564-1616), English poet and dramatist, was christened Apr. 26, 1564, at Stratford-on-Avon, a prosperous market-town of Warwickshire, one of the midland counties of England. His father was of good yeoman stock, esteemed by his fellow-townsmen, and at one time high-bailiff of his town. Shakespeare's mother was an Arden and of better birth. There was a good Latin grammar



SHAKESPEARE'S HOUSE AT STRATFORD-ON-AVON, ENGLAND

school at Stratford, and the son of so prominent a citizen could hardly have escaped attending it. Whatever his actual schooling, Shakespeare's splendid equipment as a poet and a dramatist declares less the bookish man than one of "an experiencing nature." Shakespeare married in 1582, when not yet of age; and his wife, Anne Hathaway, was somewhat his senior. We know nothing of their married life except that Anne bore her husband three children, that Shakespeare appears to have loved his native Stratford and that he returned there on his retirement to live with his family. Of his children, Hamnet, a son, died prematurely in 1596. His daughters, Susanna the first born, and Judith, twin with Hamnet, survived him, both marrying well. The direct line of Shakespeare came to an end on the death of his granddaughter, Lady Barnard, in 1670.

The circumstances of Shakespeare's coming up to

London are obscure. It was doubtless the call to support his wife and family as much as that of any definite ambition. It has been surmised that he became interested in the theater as a boy, attending in the crowd the festivities of the Queen's entertainment by the Earl of Leicester at Kenilworth in 1576, and that he was early associated with a company under the patronage of Lord Strange. This would give Shakespeare a considerable period of apprenticeship to the stage. Another opinion holds that the poet did not at first associate himself with any theatrical company, that he may have taught school and later drifted into playwriting, finding his earliest touch with the stage with the Earl of Pembroke's players, a short-lived but successful company, about 1592. However, it is certain that in the early '90s Shakespeare was busy with his narrative poems, for *Venus and Adonis* was printed in 1593 and *The Rape of Lucrece* in 1594. Some scholars place also the writing of the *Sonnets* in these years, although the collection was not printed until 1609. Both of the narrative poems are dedicated to the young Earl of Southampton, Shakespeare's patron at this time. It is interesting to recognize that Shakespeare's earliest repute should have come to him as a non-dramatic poet.

Whenever Shakespeare may have joined the stage, there is nothing to discredit the traditions of a humble beginning: holding horses outside the theater as a country boy might well do, or helping about the playhouse. By the year 1594 Lord Strange's men through various combinations and vicissitudes had become the Lord Chamberlain's men, and this company of actors was taking the lead in the profession. In Mar. 1594 an entry of the Treasurer records payment "to William Kemp, William Shakespeare and Richard Burbage, servants to the Lord Chamberlain" for comedies acted at court. Kemp was the most notable comedian of his time; Richard Burbage the greatest tragic actor. Shakespeare's name in an equality such as this means a position already well assured. And Shakespeare's position and source of revenue, we know, was threefold. He was a sharer with several others in the company, a joint-stock association, holding a half interest, the other half being the inheritance of Richard and Cuthbert Burbage from their father, a builder of theaters and exploiter of plays. Secondly, Shakespeare was an actor, playing probably such dignified parts as the Ghost in *Hamlet* or Adam in *As You Like It*. Thirdly, Shakespeare was certainly paid for his plays: how or in just what proportion we do not know. But, appreciated from the first, with a reputation steadily growing, we may feel sure that it was his plays that made the success of the Chamberlain's men.

Shakespeare came to his life-work when the English drama had already reached, in the hands of CHRISTOPHER MARLOWE and his fellows, a vigorous young manhood; and he owed much to his predecessors. His career seems to have extended a decade or more on either side of 1600. During that period he wrote in whole or in part, some 37 plays, besides the non-

dramatic works already mentioned. Of the plays only 16 were published in his lifetime, and few if any of them with his permission, much less his personal supervision. It was against the interests of the players so to part with their plays while they still possessed an acting potentiality. In 1594 a quarto edition of *Titus Andronicus* was published and the second and third parts of *Henry VI*, in earlier version, also. Shakespeare's name, in accord with the usage of the period, does not appear on the title pages of any of his earlier plays, not indeed until 1598. But between 1594 and 1623, the date of the publication of the First Folio of Shakespeare's collected plays, upwards of 50 quartos, editions of single plays, appeared in print, some of them offering bad or pirated texts, some of them based on authentic copy; most were in but one or two editions, others, like *Richard III* and *Henry IV*, ran into six editions, or, like *Hamlet*, *Romeo* or *Pericles*, into four.

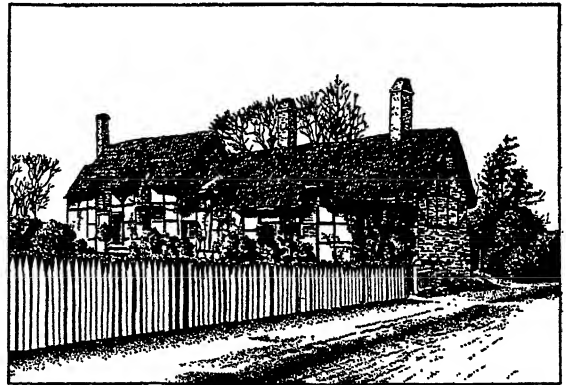
Shakespeare began in accordance with the practice of his age with the remodeling of older plays. Such are the three plays on *Henry VI*, produced 1590-92, and several others. The first of these begot the earliest of a long series of contemporary allusions to the dramatist and his work; for example, that of ROBERT GREENE, a rival playwright, who attacked him in 1592 as "in his own conceit the only shake-scene in a country." Shakespeare's other beginnings disclose experimental efforts such as *THE COMEDY OF ERRORS*, 1591, a drama of disguise modeled on Latin comedy, and *LOVE'S LABOUR'S LOST*, 1594, an improvisation and his only play not traceable to some known original. Shakespeare was influenced by JOHN LYLY, the exponent of court comedy, and by Marlowe whom he followed in the dramatic exploitation of English history in such plays as *Richard III*, 1592, and *Richard II*, 1595. The series of *CHRONICLE PLAYS*, as they are called, eventually absorbed a third of the poet's dramatic activity, and furnished, in *Henry V*, 1598, Shakespeare's ideal of a hero-king and in *FALSTAFF*, of the *Henry IV* plays, 1597-98, the greatest comedy figure of all time.

By 1595 Shakespeare had struck his gait in the romantic comedy of *THE MERCHANT OF VENICE* and in the great tragedy of *ROMEO AND JULIET*, revised perhaps by that date from an earlier form. And thereafter followed success, from "the joyous comedies," *MUCH ADO ABOUT NOTHING*, *AS YOU LIKE IT* and *TWELFTH NIGHT*, 1598-99, and the more serious and satiric group comprehending *TROILUS AND CRESSIDA*, *All's Well that Ends Well*, 1602, and *MEASURE FOR MEASURE*, 1604, to the tragedies, *HAMLET* and *Julius Caesar*, which were probably on the stage by 1600. Later came the other great tragedies, *OTHELLO*, 1604, *MACBETH*, 1605, *KING LEAR*, 1606, and *ANTONY AND CLEOPATRA*, 1607, with lesser plays between.

Shakespeare's company had enjoyed the favor of Queen Elizabeth which even the doubtful troubles of the Essex Conspiracy in 1601 did not disturb. With the accession of King James, in 1603, the players, now called the King's company, enjoyed a still

brighter degree of favor, their plays and acting acclaimed by court and city alike. Shakespeare is described in 1612 as of Stratford and as "a gentleman." In London he resided, about 1596, in St. Helen's Bishopsgate, not far from The Theatre where his earlier plays were acted. About 1599 he is traced to the Bankside in Southwark, whither The Theatre had been removed and re-erected as the Globe. Still later, about 1604, he lodged for a time in Silver Street, Cripplegate, with a French family named Mountjoy. As a rising man, Shakespeare sought and obtained the grant of a coat of arms for his father in 1596. As a well-to-do man he invested in property in Stratford and in tithes there. His share in the two theatres of his company, the Globe which was built in 1599, and the Blackfriars, occupied from 1609, was constantly increasing in value. The stamp of industry and success was upon him. There is, in short, nothing to impeach the essential integrity of Shakespeare's character except the slanderous interpretation sometimes put upon the *Sonnets*. The circumstances underlying the writing of them remain undiscoverable. But in view of the literary fashions of the time, a biographical interpretation is by no means imperative. And even if Shakespeare's *Sonnets* must be taken as a page from the poet's life, the story in its outcome is not one in which vice has triumphed to the undoing of a noble nature.

In the last period of Shakespeare's activity he turned to plays of a reconciling nature, "romances" as they have been called, such as *CYMBELINE*, 1609, *THE*



ANNE HATHAWAY'S COTTAGE AT SHOTTERY, NEAR STRATFORD

WINTER'S TALE, 1610, and *THE TEMPEST*, 1611, maintaining in them and in the repeated performances of his earlier plays his leadership despite the popularity of rivals like BEN JONSON, FRANCIS BEAUMONT and JOHN FLETCHER. It is not to be denied that there was a development in the genius of Shakespeare rising from a distinguished apprenticeship to the glories of *HAMLET*, *LEAR* and *MACBETH*. But in their differing kind, there is little falling off in the "romances," save perhaps in a certain carelessness that was prone to leave to lesser hands the lagging later scenes of *Cymbeline*, parts of *Henry VIII*, a belated chronicle history, and very much of *Pericles*. Shakespeare was

active up to at least 1612 or 1613, although his visits back to Stratford were doubtless more frequent and his stays there longer.

Shakespeare retired a substantially rich man and able to maintain the estate of a country gentleman. In this he shared in the prosperity of other leaders in his profession, Edward Alleyn and the Burbages. At "the great house" as his home, New Place, was known, we may conceive of him as dispensing hospitality to such old-time associates as Ben Jonson and MICHAEL DRAYTON, the poet. Shakespeare's wife, who was to survive him, was with him and his favorite daughter, Susanne, now the wife of a reputable physician. Dr. John Hall resided near. Shakespeare fell ill early in 1616 and making his will under the circumstances hastily though equitably and affectionately, died Apr. 23d of that year, the traditional day of his birth. He lies buried in Trinity Church, Stratford, within the chancel-rail and before the altar, a place of conspicuous honor, recognized then by his fellow-townsmen as their most illustrious citizen as by all the world as the greatest of poets and dramatists. See also DRAMA; ELIZABETHAN DRAMA; ENGLISH LITERATURE; STRATFORD-ON-AVON. F. E. S.

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SHAKESPEAREAN DRAMA. See PRE-SHAKESPEAREAN AND SHAKESPEAREAN DRAMA.

SHAKESPEARE-BACON CONTROVERSY. See BACON-SHAKESPEARE CONTROVERSY.

SHALE, compacted muds and CLAYS, forming about 80% of the SEDIMENTARY ROCKS. Shale has a thinly laminated structure, due to bedding in the original sediments, and splits easily into small, thin fragments. Metamorphic action transforms it into SLATE, in which a cleavage is developed by pressure, which may have no relation to the original bedding.

Shale consists largely of KAOLIN, with some MICA, and even QUARTZ, in grains too fine to be seen without a microscope. It consists of the residual material from rock WEATHERING, transported and redeposited by running water. Increase of the quartz brings about a transition to SANDSTONE, while through the presence of CALCITE, shale may grade into LIMESTONE.

Pure kaolin shale is white, but iron and organic matter usually color it some shade of red, yellow, green, blue, or black.

Shale is used in making tile, brick, pottery, and Portland cement. It is of very common occurrence. See also OIL SHALE; MARL; METAMORPHISM; PETROLOGY.

SHALER, NATHANIEL SOUTHGATE (1841-1906), American geologist, was born at Newport, Ky., Feb. 22, 1841. He was graduated from Lawrence Scientific School, Harvard, in 1862, and served in the Union Army two years. He joined the Harvard

faculty in 1868 as professor of paleontology, became professor of geology in 1887, and dean of the Lawrence School in 1891. During 1873-80 he directed the Kentucky Geological Survey, and in 1884 was appointed director of the Atlantic division of the U.S. Geological Survey. He published a long list of scientific works, among them *The Interpretation of Nature*, 1893, *The United States of America*, *The Story of Our Continent*, *Man and the Earth*, 1905. He died at Cambridge, Mass., Apr. 10, 1906.

SHALLOT (*Allium ascalonicum*), a bulbous plant of the lily family very closely allied to the onion from which it differs in its smaller size, slender leaves and somewhat angular bulbs that divide into several distinct bulblets. The shallot, believed to be a cultigen of Asiatic origin derived from some form of the onion, is used like garlic for flavoring. The plant is but sparingly cultivated; the bulbs marketed as shallots are mostly small onions.

SHAMANISM, the name commonly applied to the religion of certain Finnish peoples of Siberia, notably the Ostiak, Samoyed and Tungus, and also to all similar types of religion. The professional shaman is a combination of priest, medicine man and prophet and is always a specialist in magic. Supernatural helpers whom he invokes in periods of fasting and self-induced hysteria support him. He has visions and dreams and his soul is supposedly transported to the abode of the dead who enable him to remove disease from the bodies of the living.

SHAMEEN or **SHA-MIEN**, an artificial island in the Pearl River, opposite Canton, comprising the foreign settlement, and separated from the city by a narrow channel. Following the Arrow War of 1856, the British and French evacuated Canton proper and in 1861 the European commercial houses and consulates were established on Shameen, formerly a large sandbank.

SHAMOKIN, a borough in Northumberland Co., eastern Pennsylvania, situated on Shamokin Creek, 45 mi. northeast of Harrisburg. It is served by the Pennsylvania and the Reading railroads. The district is in a good farming country. Anthracite coal mining is the chief industry. Shamokin has various factories turning out silk and clothing. In 1929 the retail trade amounted to \$11,532,259. Shamokin was incorporated in 1864. Pop. 1920, 21,204; 1930, 20,274.

SHAMROCK, a small plant with trifoliate leaves used as the national emblem of Ireland. The lesser hop clover (*Trifolium minus*), a slender trailing species with small yellow flower-heads, is generally regarded as the true shamrock. Several other plants, with small leaves divided into three leaflets, are also more or less used as the national badge. Among these are the white clover (*T. repens*), the bird's-foot clover (*Lotus corniculatus*) and the wood sorrel (*Oxalis Acetosella*). According to tradition, St. Patrick employed the shamrock to illustrate the doctrine of the Trinity.

SHANGHAI, the leading port of China and one of the great cities of the world. It is situated in

the province of Kiangsu, 13 miles up the Huang P'u River, which connects with the Pacific Ocean by means of an estuary of the YANGTZE KIANG River into which it empties. Tall, modern buildings rise on the bund of this seaport, originally a fishing village, but developed within the past hundred years, chiefly through foreign initiative, into a cosmopolitan sophisticated city, the door for almost half the trade of entire China. Its natural position near the mouth of the Yangtze and on the Grand Canal and other inland waters leading to the sea makes it unique in China as an outlet for the interior.

The history of Shanghai dates back 2,152 years. It was walled in 1554 to guard against Japanese pirates. This battlement was removed after the revolution of 1911. Opened to foreign trade by the Treaty of Nanking, 1842, Shanghai soon had a foreign settlement and later a French concession. It was converted into a manufacturing city after the SINO-JAPANESE WAR in 1895 and became increasingly important as the harbor was developed following the Boxer outbreak in 1900. At present the city of Shanghai is divided into two principal sections, the foreign-controlled areas, including the international settlement and the French concession, and the Chinese city. The international settlement is controlled by a council elected by the foreign rate payers, but with nine Chinese participants in the council or the principal departments. The French concession is controlled by a council which includes French and Chinese, and is under the general supervision of the French Consul. The Chinese city is under the control of the Chinese authorities. For a number of years there has been considerable discussion and friction between the Chinese and the foreigners over the future status of the foreign controlled areas, the Chinese demanding a larger participation in the control than the foreigners were ready to grant. In 1930 the Chinese government created a special municipality called Greater Shanghai which includes the Chinese city and small villages bordering the foreign settlement. The Chinese are endeavoring to extend the power of the Chinese authorities in Greater Shanghai over the international settlement and the French concession.

Following continued disputes between China and Japan over the boycotting of Japanese goods, Japanese marines landed at Chapei, adjacent to the Japanese section of the International Settlement, on Jan. 28, 1932. A 40-day conflict ensued in spite of the efforts of the League of Nations and World Powers to intervene. On May 5 the two countries signed a truce agreement, and Japan shortly withdrew her troops.

Shanghai is becoming an important educational center. It contains a number of colleges and universities both foreign and Chinese.

Nearly half of all Chinese foreign trade passes through Shanghai. The city also is the largest manufacturing center in China. The financial interests of the country, both foreign and Chinese, have their headquarters at Shanghai. Since the establishment of the capital of China at Nanking, Shanghai has

tended to become a diplomatic center also. The total population of Greater Shanghai is approximately 3,000,000. Something over one million of these are in the international settlement, and, roughly, half a million in the French concession. The total foreign population of these two areas in 1929 was approximately 60,000, the rest being Chinese. Among the foreigners the Japanese are the most numerous, British, Russians, Americans and French coming next in that order.

SHANNON, SIR JAMES JEBUSA (1862-1923), American painter, was born at Auburn, N.Y., Feb. 3, 1862. He studied in London under Edward Poynter, and became one of England's leading portrait painters. He was an Associate in the National Academy and was knighted in 1922. His works in America include *Girl in Brown*, Corcoran Gallery, Washington; *Miss Kitty*, Carnegie Institute, Pittsburgh; and *Fairy Tales* and *Magnolia*, in the Metropolitan Museum, New York. The artist died in London, Mar. 6, 1923.

SHANNON, the longest river in Ireland and in the British Isles. Winding south and west from its source in the hills of County Cavan, the stream runs its course of 245 mi. through the fertile central plains, widens out to form Loughs or Lakes Allen, Boderg, Forbes, Ree and Derg, encounters mountains and rapids on its way to Limerick, and finally empties into the Atlantic Ocean between Loop Head and Kerry Head after draining an area of 4,544 sq. mi. Its estuary is 60 mi. long. Chief among its affluents are the Suck, Inny and Brosna. As the only navigable river in Ireland, the Shannon is an artery for trade, from its mouth almost to its source; canals connect it with Dublin and Belfast. The Shannon is the source of power for a \$35,000,000 government-owned electrification system, which during the winter of 1929-30 began to supply electricity to the Irish Free State. Intake gates control the passage of water into a canal 7½ mi. long leading to the power house. Excellent trout and salmon fishing have made the river popular with sportsmen.

SHANTUNG, a province of northeastern China, bordering on the Yellow Sea and embracing an area of 56,000 sq. mi. In the east the province is mountainous, but in the west and northwest there are extensive alluvial plains traversed by the Huang Ho River and the Grand Canal. The hilly regions are arid but the plains and valleys are fertile and produce cereals, vegetables and fruits. The silk industry is highly developed. Horses, mules, cattle, sheep and goats are bred in large numbers. Shantung province is particularly rich in minerals. There are vast deposits of coal and iron, and lead, copper and gold are also mined. TSNAN is the capital, and CHEFOO, on the northern coast, is the chief port. Pop. 1923, 30,803,245.

SHANTUNG AGREEMENT, 1922, a treaty between China and Japan. The Chinese city of Shantung, in German control at the beginning of the World War and seized by Japan in the course of the

war, was by the Treaty of Versailles (article 158) left in Japanese control. Anti-Japanese agitation spread over the Republic of China; a boycott of Japanese goods was largely successful. During 1920 and 1921 China refused to negotiate on the subject, since such action would imply the acceptance of the objectionable principle that Japan had certain rights in the city and the province (Kiao-chow), until at the WASHINGTON CONFERENCE, on Nov. 30, both parties to the dispute accepted the mediation of Great Britain and the United States. The resultant agreement, embodied in treaty form and signed Feb. 7, 1922, involved the immediate transfer to China of Shantung and the former German concessions at the port; payment by China to Japan of 53,406,151 gold marks in treasury notes, as the value of properties taken by Japan from the Germans, together with improvements made by the Japanese; transfer of the Kiao-chow mines to a special company in which Japanese capital might equal Chinese capital.

SHANTZ, HOMER LEROY (1876-), American educator, was born in Kent Co., Mich., Jan. 24, 1876. He graduated from Colorado College in 1901 and took his Ph.D. at the University of Nebraska in 1905. After teaching botany in various colleges from 1901-07, Shantz joined the Bureau of Plant Industry, United States Department of Agriculture, as an expert and plant physiologist, conducted many useful researches, and lectured widely on plant geography. He was professor of botany at the University of Illinois from 1926-28, when he became president of the University of Arizona.

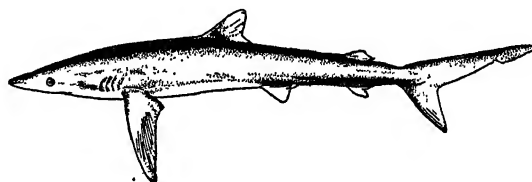
SHAPERS, MACHINE TOOLS in which the work is held stationary and the cutting tool is carried in a head or ram which travels back and forth across the work.

SHAPLEY, HARLOW (1885-), American astronomer, born at Nashville, Mo., Nov. 2, 1885. He studied at the University of Missouri and at Princeton, where he took his Ph.D. under Russell in 1914. From 1914 to 1921 he was astronomer at the Mt. Wilson Observatory, and in 1922 became director of the Harvard Observatory. His earlier work consisted chiefly in researches on photometry and on star clusters, by means of which he enlarged the known dimensions of the Milky Way system tenfold. Later he turned his attention to variable stars and the structure of the Milky Way as well as to the problem of the spiral nebulae and the distances in the universe at large.

SHARES. See STOCK.

SHARK, the name for a numerous group of large, powerful, usually very active fishes, embracing about 150 species found in all seas but most abundant in tropical waters. In size sharks range from slender Dog Fish, scarcely a foot long, to huge basking sharks, sometimes 50 ft. in length. From most other fishes sharks differ chiefly in having a cartilaginous instead of a bony skeleton. They differ also from the bony fishes in having several, usually 5, gill-slits opening on each side of the body instead of one long gill-slit

covered with an opercle. The mouth, which is beneath the head, is situated at considerable distance back of the snout. Because of this peculiarity sharks often turn over on their backs to seize their prey. Most sharks have very numerous exceedingly sharp triangular teeth, sometimes provided with sawlike edges. However, the teeth of those that feed on mollusks are tubercular and mill-like, adapted for



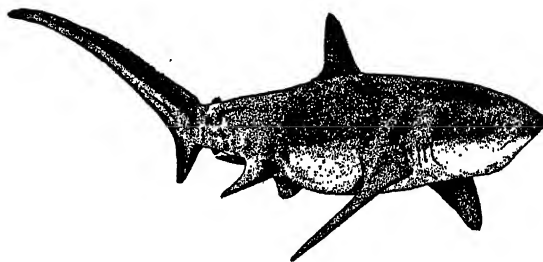
COURTESY AMER. MUS. OF NATL. HISTORY

SMALL BLUE SHARK

crushing shells. A few species, as the basking sharks, which subsist on minute organisms strained from the sea, have very small teeth.

Many sharks are ovoviviparous, the eggs hatching and the young attaining considerable size within the body. Others lay large eggs enclosed in leathery cases, often of peculiar form, as rectangular with hooked appendages at the corners or twisted in spirals or coils.

Various sharks are exceedingly destructive to smaller fishes, and also to lobsters, crabs, squids, and other invertebrates, but very few are dangerous to man. Among the types represented in North American waters are the bullhead, cow, cat, nurse, requiem, hammerhead, thresher, mackerel, basking, and whale



THRESHER SHARK

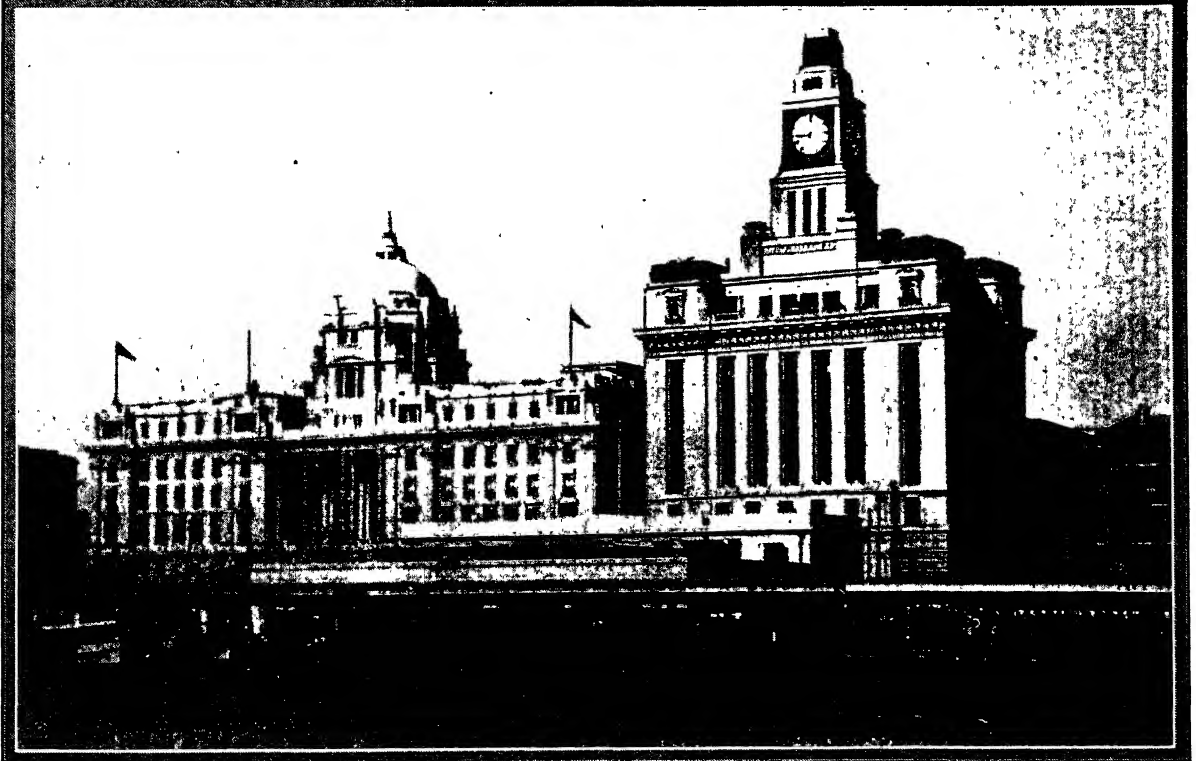
sharks and also the dog-fishes. Of these, only the powerful man-eater shark (*Carcharodon carcharias*), a huge mackerel-like species, sometimes 40 ft. long, is definitely known to attack bathers.

The economic value of sharks is slight. A few yield oil and the rough skin of certain forms is used for polishing. In India and China dried shark fins, employed in making soups, are an article of commerce. The flesh of various species is wholesome and nutritious, though but sparingly utilized. See also HAMMERHEAD.

A. B. J.

SHARON, a city of Mercer Co., Pa., on the Shenango River, 15 mi. northeast of Youngstown, O. It is served by the Erie, the Pennsylvania and,

SHANGHAI



1, COURTESY RED STAR LINE; 2, HAMBURG-AMERICAN LINE

ALONG THE FAMOUS BUND OF SHANGHAI, CHINA

1. View of the Bund or Boulevard, center of sea life in the great eastern port. 2. The Custom House (left) and the Chamber of Commerce Building on the Bund, seen from the Whang Poo branch of the Yangtze River.

for freight, the New York Central and the Pittsburgh and Lake Erie railroads. Sharon adjoins the boroughs of Farrell, Sharpsville and Wheatland, which together form an industrial unit. The value of manufactures, chiefly iron and steel products, auto frames and accessories, gas engines, tanks, fire-bricks, and electrical transformers, was about \$37,000,000 in 1929; the retail trade in the same year amounted to \$14,561,254. Coal-mining, begun in 1836, is an important industry. Settled by Benjamin Bentley, 1795, Sharon became a borough in 1841 and a city in 1918. James A. Davis, former Secretary of Labor, is a resident. Pop. 1920, 21,747; 1930, 25,908; 9% foreign-born.

SHARP, WILLIAM (1856-1905), Scottish poet and writer, also known as Fiona Macleod, was born at Paisley, Sept. 12, 1856. He was educated at Glasgow University, went to London and began contributing to the magazines. Under his own name he published several volumes of poetry, including *The Human Inheritance*, 1882, and *Earth's Voices*, 1884. He also wrote biographies of D. G. Rossetti, Shelley, Heine and Robert Browning. Not until after his death was Sharp identified as the author of the works of "Fiona Macleod." These, both poetry and prose, surpassed the writings he had acknowledged, and were distinctly of the Gaelic revival. He himself believed them to have been inspired by the spirit of a woman. Among the Fiona Macleod books are *The Sin-Eater*, 1895, *The Washer of the Ford* and *Winged Destiny*, 1904. Sharp died at Castello di Maniace, Sicily, Dec. 12, 1905.

SHARP, in musical NOTATION, a sign written thus ♯, indicating that the note before which it appears is to be raised in PITCH a semitone, technically, an augmented prime or unison. Prior to 1500 it was identical with the natural-sign, thus ♮, being called *B cancellatum* or sign which cancelled *B rotundum* or "round B" which indicated B flat as opposed to *B quadratum* or "square B" which indicated B natural. After 1500 a distinction between the natural sign and the sharp sign was made, the latter being used only to raise the pitch of a note which was already natural. Thus, F sharp is a semitone higher than F, but B natural is a semitone higher than B flat. The double sharp, written variously ##, ‡, * and †, but to-day almost always thus X, indicates that the note before which it is placed is to be raised two semitones. When so used, sharps are called accidentals; but when they are placed at the beginning of a composition they are called the SIGNATURE. In the former case they affect notes only within the given measure; in the latter, they affect the entire composition. In JUST INTONATION the pitch of F double sharp and G natural is different, but in equal TEMPERAMENT the two pitches are identical.

SHARPSBURG, a borough and industrial suburb of Pittsburgh, in Allegheny Co., southwestern Pennsylvania, situated on the Allegheny River. It is served by two railroads. There is an airport. The vicinity has coal mines and oil wells. Iron and steel provide the chief industrial activities; glass, varnish and

lubricating oil are other local manufactures. The Pennsylvania Railroad has yards here. Sharpsburg was founded and incorporated in 1842. The borough contains a monument to Chief Gugusuta, a famous Indian born on this site. Pop. 1920, 8,921; 1930, 8,642.

SHARPSHOOTER, a rating determining the degree of qualification in rifle marksmanship. The rating is given a soldier for attaining in the record course a score between 290 and 306. It entitles him to wear a sharpshooter's badge and to receive compensation in the amount of three dollars per month for one year from date of qualification.

SHASI, a treaty port on the Yangtze River in the cotton growing section of Hupeh province. City canals by a complicated waterway system carry the trade to outpoints. The leading industries are cotton and vegetable tallow. Chief exports include these products and silk manufactured to the north of the city. It has steamer trade with Hankow by way of the Yangtze and junk trade with interior cities on the Han River to which it is connected. Foreign business was formally opened by the Treaty of Shimonoseki in 1896. Pop. 1929, 95,843.

SHASTA, MOUNT, a perpetually snow-clad mountain in the Sierra Nevada of northern California, 40 mi. south of the Oregon boundary line. The mountain stands out in majestic isolation and can be seen for hundreds of miles. The summit, a favorite objective for mountain climbers, is 14,380 ft. high and commands a glorious view of northern California and Oregon. Above 13,000 ft. the peak has no vegetation. Glaciers are on the northern slopes. Butterflies, mice and hawks are among the few animals which venture to the top of the peak. Though of volcanic origin, Shasta is now considered extinct. It bears, however, definite signs of volcanic activity. At the summit and on the northern side are sulphurous fumaroles emitting hot gases and an old crater, 4,000 ft. in diameter and 2,500 ft. deep lies 1,400 ft. below the top. The National Park-to-Park Highway runs close to the base of Mt. Shasta to Sisson, Cal.

SHASTAN, a North American Indian linguistic stock comprising two principal groups, the Sastean and the Palaihnihan or Pitt River Indians. This stock formerly occupied the drainage of the Klamath and Pitt rivers, the Stewart, a portion of the Salmon, the headwaters of the Sacramento and the upper McCloud rivers. They lived in permanent villages composed of rectangular, semi-subterranean plank houses. Salmon caught by net, weir, trap and spear were an important item in both winter and summer diet. Their arts were exceedingly crude.

SHAW, ANNA HOWARD (1847-1919), American suffragist leader, was born in Newcastle-on-Tyne, Eng., Feb. 14, 1847, and brought to America when a child. She studied at Albion College, 1872-75, at Boston University School of Theology until 1878, but on the refusal of the Methodist Church to ordain her because of her sex, she turned to lecturing during the next seven years, studied medicine and

received the degree of M.D. at Boston University in 1885. That year she lectured for the Massachusetts Woman's Suffrage Association, and in 1886-92 was national superintendent of franchise for the W.C.T.U. She was national lecturer for the National American Woman's Suffrage Association in 1886-1904, and president of that body in 1904-15. She then resigned to devote her entire time to campaigning, and by her effective work hastened the adoption in 1919 of the 19th Amendment providing for woman suffrage. She died at Moylan, Pa., July 2, 1919.

SHAW, GEORGE BERNARD (1856-), British playwright and social satirist, was born at Dublin, July 26, 1856, the same year in which Oscar Wilde was born. In Dublin he had been educated chiefly in music and painting, and when he came to London at the age of 20, he completed his education by devouring Henry George and Karl Marx and Henrik Ibsen, and by joining the Fabian Society. He served as art, music and drama critic, wrote several novels and produced his first play in 1892. His dramatic reviews for the *Saturday Review* have been published in book form and are now available in *Dramatic Opinions*, 1907, an invaluable record of those early days. The first collection of plays published was entitled *Plays, Pleasant and Unpleasant*, 1898, and included *Mrs. Warren's Profession*, *Candida* and *Widowers' Houses*. The volume entitled *Three Plays for Puritans* appeared in 1900 and contained *The Devil's Disciple*, *Caesar and Cleopatra* and *Captain Brassbound's Conversion*. Shaw's masterpiece, *Man and Superman*, 1903, was followed by *John Bull's Other Island*, 1903, and *The Shewing-Up of Blanco Posnet*, 1909. After *Fanny's First Play*, 1911, and *Androcles and the Lion*, 1912, there appeared the post-war drama, *Heartbreak House*, 1917. Later plays were *Back to Methuselah*, 1920, a cycle of five plays in one; *Saint Joan of Arc*, 1923, and *The Apple Cart*, 1929.

The unconventional satire of Ibsen and Nietzsche as well as the sociological implications of Marx and Darwin are reflected in Shaw's comedies of ideas. His aim is to destroy social errors through laughter, and he has been called the most brilliant wit the English stage has produced. The brilliance and the unique dramatic genius of his plays have firmly established Shaw's reputation as the foremost English dramatist of his generation. As critic and publicist, too, Shaw has made his influence felt. His miscellaneous writings have appeared partly as prefaces to his plays and partly as political and economic pamphlets. The most famous of the latter were the early *Fabian Essays* and *Fabian Tracts* and the political pamphlets entitled *Common Sense About the War*, 1914, and *Peace Conference Hints*, 1919. A more recent volume that led to considerable comment and illustrates Shaw's latter-day interests is *The Intelligent Woman's Guide to Socialism and Capitalism*, 1928. In line with these interests Shaw's brief visit to Soviet Russia in 1931 and his vigorously expressed reactions thereto aroused unusual discussion and world-wide press comment.

Later the same year appeared *Ellen Terry and Bernard Shaw; A Correspondence*.

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SHAW, HENRY WHEELER (1818-85), American humorist, better known by his pen name, Josh Billings, was born at Lanesborough, Mass., Apr. 21, 1818. He left Hamilton College and went to the West, where he remained for 22 years. In 1858 he settled in Poughkeepsie, N.Y., and began to write. His crude but pithy humor made his pen name famous. Among his books are *Josh Billings; His Sayings*, *Josh Billings, His Works Complete* and *Josh Billings' Old Farmers' Allmenax*. Shaw died at Monterey, Cal., Oct. 14, 1885.

SHAWINIGAN FALLS, the power center of St. Maurice Co., Quebec, Canada, situated on the St. Maurice River, about 95 mi. southwest of Quebec. The Shawinigan Water and Power Company is situated at this place from which it supplies an extensive area. Shawinigan Falls is an important center in the Canadian wood pulp and paper industry. It was founded and incorporated in 1902. Pop. 1921, 10,625; 1931, 15,345.

SHAWNEE or **SHAWANGO**, an important North American Indian tribe of Central Algonkian stock. When first known its members were divided into two groups, one living in the Cumberland basin in Tennessee and the other in South Carolina where they were called the Savannah. After frequent shifting due to the encroachments of the whites the two groups united in 1756 on the upper Ohio river. They revealed themselves as the most hostile tribe in the Northwest, first against the English and later against the Americans, in the French and Indian War, Pontiac's War, the American Revolution and the War of 1812. Tecumseh and his brother, the medicine-man Tenskwatawa who conducted the Tippecanoe campaign, were Shawnee. Survivors of the tribe are now in Oklahoma.

SHAWNEE, a city in Pottawatomie Co., situated near the center of Oklahoma on the North Canadian River about 40 mi. southeast of Oklahoma City. Bus lines, air service, and three railroads serve the city. The principal crops raised in the vicinity are cotton, corn, alfalfa and garden produce. The city is a market center for the rich oil fields of the region. The local industries include flour milling, overall and tool manufacturing. The factory output in 1929 amounted to approximately \$5,000,000; the retail trade reached a total of \$19,240,203. Shawnee was founded about 1895. Pop. 1920, 15,348; 1930, 23,283.

SHAW UNIVERSITY, at Raleigh, N.C., a co-educational Negro institution, was founded in 1865 under the auspices of the American Baptist Home Mission Society to educate colored preachers for the Baptist ministry. It includes normal collegiate scientific and industrial departments, a theological school, missionary training school, and schools of medicine, pharmacy and law. The grounds and buildings are valued at \$620,526, and the library contains 10,801

volumes. In 1930 there were 300 students and a faculty of 33, headed by Pres. J. L. Peacock.

SHAYS, DANIEL (1747-1825), American soldier, was born at Hopkinton, Mass., in 1747. Little of his life is known until 1775, when he took part in the Battle of Bunker Hill as a second lieutenant. Two years later he was promoted to a captaincy. Shays distinguished himself at Stony Point and Saratoga, after which he resigned from the army. He chiefly figures in American history as the leader of "SHAYS' REBELLION" in 1786-87. Shays was eventually pardoned, and awarded a pension for his services in the Revolutionary War. He died at Sparta, N.Y., on Sept. 29, 1825.

SHAYS' REBELLION, an uprising in western Massachusetts, 1786-87. Debts and burdensome taxes, a depreciated currency, exorbitant legal fees and conservative courts which enforced the letter of the law in favor of creditors, were causes of a pervasive discontent among the common people. The western part of the state was particularly embittered because of the control of the state government by eastern representatives. Daniel Shays, a captain in the Revolutionary War, organized the malcontents. Armed mobs prevented the sitting of several local courts, and in Sept. 1786 Shays with 600 followers broke up a session of the State Supreme Court at Springfield. On Jan. 25, 1787 Shays headed a mob of 2,000 men in an attempt to seize the Federal arsenal at Springfield. He was opposed by Gen. Shepard with 1,200 militiamen, and his forces were repulsed and scattered. After several minor skirmishes, the insurgents disbanded. Fourteen of the leaders were sentenced to death for treason, but were subsequently pardoned and a general amnesty proclaimed.

SHEARING MACHINES. See PUNCHING AND SHEARING MACHINES; PRESSES AND PRESSWORK.

SHEARWATER, a genus (*Puffinus*) of strong-winged ocean birds of the petrel family (*Procellariidae*) so called from their habit of skimming close over the surface of the water. They occur in nearly all the seas and oceans of the world, rarely venturing far from land but coming ashore only at nesting time. Shearwaters, usually from about 12 to 20 in. long, are sooty-brown or grayish in color, with long slender bills, long pointed wings and webbed feet. They subsist largely on fish and floating animal matter and nest in burrows, laying a single white egg. Among the best known species reaching the shores of North America are the greater shearwater (*P. gravis*), of the entire Atlantic, frequenting the eastern North American coast in summer; Audubon's shearwater (*P. lherminieri*) of the West Indies and the warmer Atlantic; the sooty shearwater (*P. griseus*), which summers on both the Atlantic and Pacific coasts, and the blackvented shearwater (*P. opisthomelas*), occurring along the California coast.

SHEATHBILLS, a small family (*Chionidae*) of seabirds native to the extreme southern portions of South America and the antarctic islands. Although closely resembling pigeons in appearance, they are con-

sidered to be more closely allied to the plovers. They are over a foot long, snowy white, and bear a horny, saddle-shaped sheath at the base of the upper mandible.

SHEBOYGAN, a lake port city in southeastern Wisconsin, the county seat of Sheboygan Co., situated on Lake Michigan, at the mouth of the Sheboygan River, 52 mi. north of Milwaukee. Bus lines, lake steamers and the Chicago and Northwestern Railroad afford transportation. Kohler Airport is 3 mi. away. Sheboygan is a shipping center for farm and dairy products, especially cheese. The chief manufactures are furniture and enamel ware. In 1929 the factory output was approximately \$29,000,000; the retail trade amounted to \$24,370,314. Valuable mineral waters are found in the vicinity. Pop. 1920, 30,955; 1930, 39,251.

SHEELER, CHARLES (1883-), American painter, was born at Philadelphia, Pa., in July, 1883. He studied at the Pennsylvania Museum, the School of Industrial Art, and the Pennsylvania Academy of the Fine Arts. Visiting Europe, Sheeler became acquainted with the work of PICASSO, BRAQUE and MATISSE. He returned to America and exhibited at the Armory Show of 1913. In his work Sheeler seeks clarity and precision, and delights in the power and purity of geometrical forms. His attitude toward his subject-matter is detached and objective; by rigid simplification he translates in plastic terms the architectural features of houses, barns and interiors. He was one of the first to perceive the rich pictorial possibilities of an industrial civilization. His landscapes of factories and his still-lives of manufactured objects of common use are particularly notable, and form an original contribution to American art. Among Sheeler's important pictures are *Amaryllis*, Cleveland Museum of Art; and *Interior*, Whitney Museum of American Art, New York. H. M.

SHEEP, the popular name for members of a genus (*Ovis*) of ruminants, belonging to the same family (*Bovidae*) as the GOAT and the OX. They are animals of medium size. The big horn (*Ovis canadensis*), the largest American wild species, may stand 40 inches at the shoulder. Horns are commonly present in both sexes, but those of the male are much larger and heavier than the female's, and they curve outward, frequently forming a large spiral. There are two types of hairy covering; the woolly underfur, which has developed into the fleece of domestic species, and the outer hair, which acts as a raincoat to wild sheep. The latter has been almost lost by the domesticated forms.

Several species of wild sheep are found in the mountains of Central Asia and North America, while the AOUDAD (*Ovis lervia*) lives in North Africa, and the MOUFLON (*Ovis musimon*) is a native of Corsica and Sardinia. They are bold climbers, and are able to live on the scant vegetation of the heights. In habits they are gregarious. Parties usually consist of several ewes and their lambs, or of adult rams. Before her lamb is born in the spring the mother often seeks a very high place, where the baby will be safe.

Sheep have been domesticated since long before historic times. The tame breeds are commonly thought to be descended from several wild species, among them, most probably, the mouflon, the urial (*Ovis vignei*) and the ARGALI (*Ovis ammon*). There were no domestic sheep in America before the coming of the white man.

SHEEP BOT-FLY, a two-winged fly of the family *Estridae*, which either lays eggs or deposits newly hatched maggots in the nostrils of sheep. The maggots crawl upward and feed on the mucous membranes, sometimes even piercing the brain and often causing "blind-staggers." When mature they drop to the ground to pupate. Among the many methods tried as preventives or remedies the following have been fairly successful though not fully satisfactory. Tar, fish oil or grease may be smeared on the sheep's noses; finely powdered tobacco or lime may be used to make the animals sneeze and dislodge the maggots, or a feather dipped in turpentine may be thrust into the nostrils.

SHEEP RAISING. Sheep are among the earliest of domesticated animals as proved by the frequent reference to and illustration of them in the ancient records of Egypt and Babylon. Even before the days of Abraham, men were rated according to the extent of their "flocks and herds," sheep, goats and cattle. This was the natural result of the adaptability of these animals to the primitive needs of the nomadic peoples and to the varying climatic conditions of one country after another as the human race spread over the world.

Since then sheep have added to the wealth, development and civilization of each new country in proportion to their numbers and the permanence of the agriculture practiced. Their adaptability is further indicated by their being able to thrive in a wide diversity of temperate climatic and soil conditions from sea level to mountain heights and upon a great variety of herbage.

No other animal has such a long list of products. Its fleece is cut for wool, which is used for clothing, carpets, felt and many other purposes. The carcass makes excellent meat. Hides with the wool on are cured and used for outer clothing in cold weather; when freed from the wool and processed they make parchment used as a writing material. Catgut is made from the dried entrails and sausage casings after cleansing treatment from the fresh ones. The rendered fat is tallow, used largely in soap making. In many countries certain breeds furnish milk which is used separately or in combination with that of cows to make cheese. Specially trained sheep are used in the mountainous parts of India as beasts of burden.

Sheep (*Ovis aries*) are horned or hornless ruminants whose ancestry is in dispute. They are presumed to have originated from related wild species but authorities are at variance as to which one and opinions differ as to whether or not any of these wild sheep are still extant. Two existing wild species usually credited as progenitors are the wild sheep or argali (*O. ammon*)

of northeastern Asia and the mouflon or musimon (*O. musimon*), natives of Corsica and Sardinia.

Three species of sheep are natives of western North America, big horn (*O. canadensis*, often also called *O. montanus* and *O. cervinus*); the white sheep (*O. dalli*) and the black sheep (*O. stonei*). None of these has been domesticated or successfully hybridized with any domestic breed, nor were any of them found by early explorers under Indian domestication.

The numerous Old World breeds, most of them originated or developed in Great Britain, are partly the result of natural causes such as climate, altitude, soil and wild herbage, but mainly of man's influence through breeding and selection. Although all breeds are more or less useful for all purposes mentioned above, some are conspicuous as producers of wool, others of meat, but the classification of breeds is based on the length of the wool. The breeds of most interest in America include the long woolled Leicester, Lincoln, Cheviot and Cotswold, raised mainly for meat; the medium woolled Dorset Horn, Tunis and the "down" breeds, such as Hampshire, Oxford, Suffolk, Shropshire and Southdown; the fine woolled Merinos in four divisions, French, Delaine, Rambouillet and American.

Though these and other breeds bespeak wonderful improvement in the animals themselves, sheep raising is still one of the most nearly primitive of agricultural pursuits. It still meets the conditions of prehistoric times, the profitable use of land too poor or inaccessible for other branches of farming, even cattle grazing. When given free range sheep are largely self-supporting so long as the available herbage is sufficient to maintain them. Hence the industry is conducted extensively in Australia, New Zealand, British India, Russia, South Africa, South America (especially Argentina), Canada and the United States and to a lesser extent in Spain, France and Great Britain.

The chief area of production in the United States is in Texas, California, Montana, Wyoming, Idaho, Oregon, Utah and New Mexico. East of the Mississippi important sheep raising states are Ohio, Michigan, Kentucky and New York. During recent years appreciation of lamb has tended to the development of a better market type of sheep, stabilized prices and profits and increased production as shown by the U.S. *Yearbook of Agriculture* as follows:

SHEEP ON FARMS, U.S.

5-Year Average, 1927-31

Division	Value per Head	Number	% of Total
UNITED STATES	\$8.97	47,359,000	100.0
LEADING STATES:			
Texas	7.20	5,113,000	10.8
California ...	9.48	3,785,000	8.0
Montana	9.46	3,733,000	7.9
Wyoming	9.48	3,431,000	7.2
Colorado ...	8.82	2,884,000	6.1
Utah	9.92	2,781,000	5.9
Oregon	9.50	2,483,000	5.2
New Mexico .	8.16	2,456,000	5.2
Idaho	10.00	2,187,000	4.6
Ohio	7.90	2,054,000	4.3

In America sheep raising has met many vicissitudes such as market demands for certain types of wool and meat, and a fluctuating tariff on wool. Since the drastic decline of wool prices in 1893, prices for lamb have increased and sheep raisers have adopted the medium wool-mutton breeds or crosses of them.

Western range management of sheep is radically different from that followed in the Old World and the Eastern States. This is mainly due to natural conditions, the comparative inaccessibility of the ranges, the extensive scale on which the animals are raised and the high cost of labor which taken together have systematized the business. In the past the animals were maintained almost wholly upon public lands in the West.

Competition for this range and settlement of the West have resulted in renting or ownership of grazing lands. Owned and leased lands are fenced and provided with facilities for watering the animals. Many sheep raisers, however, rely upon still available open range and forest lands for summer grazing, though they often control winter range close to ranch headquarters. Each flock of 2,000 to 3,000 sheep is in charge of a flockman and trained dogs which protect the sheep at night and prevent their straying. Camp tenders scout for good grazing and provide for the flockman's needs.

When autumn arrives the sheep are driven by easy stages to the winter range which has not been grazed during summer and is protected more or less from snow. In earlier days buildings were rarely provided, but it has been proved that although not essential they insure greater safety during the lambing period and make for greater profits. The shelters are usually rough open sheds. In addition to these are uncovered corrals in various places into which the sheep are driven at night to provide against possible losses during inclement weather when they cannot range. Forehanded sheepman have stores of alfalfa or other hay which they feed even to the extent of fattening more or less sheep for market. These supplies are cut and handled by hay gangs during most of the summer.

After lambing is over the sheep are sheared, usually by machine, dipped in some tick-destroying mixture which also guards against certain diseases and then driven to summer range. In Texas and Arizona, where sheep are sheared twice annually, expert shearers start the season in early spring and work northward to Montana and Idaho where they cease in early July.

Various methods of feeding and finishing sheep for market are in vogue. One consists in forcing the newly dropped lambs until about eight weeks old when they make the choicest quality of meat and therefore command the highest prices. When these animals are forced indoors they are called hot-house lambs, regardless of the season when sold. They are in great demand and when properly handled are highly profitable as the cost of feed is relatively small.

M. G. K.

SHEEPSHEAD (*Archosargus probatocephalus*), a highly prized food and game fish, found only in America along the Atlantic and Gulf coasts, where it frequents muddy bottoms, feeding on shell fish and mollusks. It is a deep-bodied fish, weighing from 6 to 20 lbs. Distinguishing marks are seven or eight vertical bands over the length of the body, and the arrangement of the teeth with incisors in front and molars behind, resembling somewhat the mouth of a sheep. Spawning takes place between March and June, depending on the locality. Though a salt water fish, the sheepshead also ascends rivers for some distance, particularly the Indian and St. Johns rivers in Florida. The name sheepshead is also given to a fresh-water DRUM (*Aplodinotus grunniens*) of the Great Lakes.

SHEEPSHEAD BAY, a small inlet of the Atlantic Ocean, projecting into a part of Brooklyn, Kings Co., N.Y. It is near Coney Island. The district on the north shore is also known as Sheepshead Bay and is a residential section, an all-year pleasure resort and the headquarters of many fishing boats and several yacht clubs.

SHEEP SORREL. See SORREL, SHEEP.

SHEEP-TICK, the louse-like larva of a degenerate reddish or brownish, wingless fly (family *Hippoboscidae*). Adults possess strongly developed, large clawed legs. The eggs not only develop in the bodies of the females but the larvæ become nearly full grown before being born. Their entire lives are spent on the bodies of sheep. In spring when they are most abundant they seriously menace the health and lives of lambs. As they spread from sheep to sheep by contact a thorough washing with "dips" after shearing usually rids a flock until reinfestation. It is important to follow directions when using the "dip" selected.

SHEER, the fore and aft curve given to the deck of a vessel. The sheer of the various decks is usually the same as that of the weather or exposed deck, the sheer being highest above the water line forward at the stem, lowest at a little after amidships and rising again at the stern, to a lower height than forward. The weather deck is given a sheer, not only to keep the deck dry, but also for appearance.

SHEERNESS, a naval seaport and garrison town of Kent, England, in the Isle of Sheppey, about 10 mi. northeast of Chatham. With an excellent harbor and a large dock-yard, the town is divided into four districts, known as Westminster, Marine Town, Mile Town and Blue Town. In the last are strong fortifications and living quarters for the staff. Fishing and trading in grains and shipping supplies form the main occupations of the inhabitants. Pop. (of district and town) 1921, 18,673; 1931, 16,721.

SHEET ASPHALT. See ASPHALT PAVING.

SHEFFIELD, a city in the West Riding of Yorkshire, England, situated in the extreme south of the county near the junction of the Don and Sheaf rivers at the foot of the Pennines Hills, 158 mi. northwest of London.

Sheffield is essentially an industrial city in which the surface relief and alternation of ridge and valley led to crowding in the valleys and a somewhat later growth over the ridges during the period of great prosperity in the 19th century. The central part of the city and the eastern valley area have a dreary appearance owing to the smoke from the hundreds of tall chimneys. But there are fine public buildings, libraries, churches, parks and gardens. The University of Sheffield began as the Firth College in 1879. It was enlarged in 1892. More than four centuries ago (the exact time is uncertain) the manufacture of steel and steel products began in Sheffield. But local iron contained too much phosphorous, and the cutlery trade thrived chiefly on iron imported at high cost from Sweden and Spain. The skill of the local craftsmen soon became an important factor in localizing the industry. Other advantages were the water power and hard sandstones for the grinding wheels. Economic conditions in the steel industry have to some extent survived from the days of small mills, for even in modern Sheffield much of the grinding is done by individual workers renting their premises and power from a landlord. Tradition and social inheritance are practically the sole geographical factors that now give greater value to Sheffield as a steel manufacturing center than any other place on the coalfields of Britain. But they are strong enough to explain the apparent anomaly of an inland town being engaged in the manufacture of heavy goods, mainly from imported ore, and being one of the great centers of ship construction of the country in spite of lack of access to the sea. The manufacture of "Special" or "alloy" and stainless steels is an important new aspect of Sheffield's leading industry. Silver and electro-plate goods are also important. Pop. 1921, 511,696; 1931, 511,742.

SHEFFIELD, a city in Colbert Co., northwestern Alabama, on the Tennessee River, opposite Florence, in the Muscle Shoals District. River craft and two railroads serve the city. The region is good farming country and has rich natural resources, including timber, iron, coal and phosphate. There are two United States nitrate plants in the vicinity. Sheffield has cottonseed-oil, lumber and rolling mills, railroad shops and foundries. About 25 mi. southeast is the Alabama National Forest and a few miles to the west is the Shilo National Military Park. Pop. 1920, 6,682; 1930, 6,221.

SHEKEL, an ancient unit of weight used by the Babylonians, equal to 1/3000 of the talent; also a Hebrew silver coin representing that weight of metal.

SHEKINAH (Talmudic Hebrew, *shekinah*, lit., the dwelling, from *shakan* to inhabit), the Divine Presence or Manifestation, a divine agency through which God rules the world, or divine intermediary between Him and the world of nature and man. It is a Jewish theological conception developed in Jewish literature and adopted by Christians. It is the Shekinah only, not God, that can be localized even in Heaven, that is the central cause of the radiance and

glory of God manifested in the storm cloud, the cloud and fire over and in the tabernacle, the cloud on Sinai's summit, etc., that was in the Temple of Solomon, and that, in the Midrash and the Talmud, is the active and personal agent of God.

The history of the term Shekinah presents a significant phase of the struggle to divest God of human attributes. In consequence of the deepening sense of the spirituality and transcendence of God, a double difficulty presented itself to the masters of the Synagogue. On the one hand, the sensuous designations and representations of God in the Bible became an embarrassment to faith. On the other hand, by freeing God from all anthropomorphic patterns, a gulf was created between the Infinite and the finite consciousness. This double difficulty made itself felt, for the first time, in the attempts to translate the Bible into the vernacular. The solution was found by resorting to the use of circumlocution and paraphrase.

The Hebrew *shekina* (Aramaic *sheqinta*) is derived from the root *shakan*, and denotes resting, abiding, dwelling. As a substitute for God, it may be rendered Divine Presence. Whenever the Pentateuchal text refers to God's dwelling among men, in the midst of Israel, in the tent of meetings, etc., in Jewish-Aramaic versions the terms *memra*, or word, *yekara*, or glory, and *sheqinta*, or presence, are generally employed.

Unlike the Logos in the teaching of Philo or in the Gospel of John, the seemingly related terms *memra*, *yekara* and *sheqinta*, as employed in the Aramaic versions, never designate "a being of any kind or in any sense, much less a personal being." G. F. Moore explains the appearance of personality, which attaches to these terms in some passages, by the fact that they are "reverent circumlocutions for 'God,' introduced precisely wherein the original God is personally active in the affairs of men; and the personal character of the activity necessarily adheres to the periphrasis" (*Judaism*, vol. 1, p. 419). They may be considered devices of translation rather than "figments of speculation."

While *memra* and *yekara* appear only in the Aramaic versions, *shekinah* figures prominently in rabbinic literature as well. Here too its use is chiefly prompted by the motive of reverence, on the one hand, and by the need of preserving the sense of Divine nearness on the other. As its usage by the rabbis is determined by popular religious needs and by poetic sentiment rather than by reasoned philosophical argument, it is extremely difficult to present a consistent rabbinic doctrine of the Shekinah. Sometimes the imagery of the Shekinah as given by one rabbi is contradicted by the presentation of another. Only the general outline of the rabbinic conception of Shekinah can be attempted in this article.

Omnipresence of the Shekinah. Though Rabbi Isaac identifies the Shekinah with wisdom (*Soza 11a*), it is in an emotional rather than in an intellectual sense that the term is generally employed. It ex-

presses the aspects of Divine love and immanence. Occasionally, where the Shekinah is a mere metonymy for God, the element of transcendence is stressed. Rabbi Jose, for example, teaches that "the Shekinah never descended on earth, nor did Moses and Elijah ascend to heaven, for it is said (Psalms 115:16): 'the heavens are the heavens of the Lord, and the earth hath he given to the children of men'" (*Sukka* 5a). However, inasmuch as the Shekinah represents the worshiper's direct communion with God or the sense of his immediacy, the rabbis did not hesitate to speak of the ascents and descents of the Shekinah (*Aboth of R. Nathan* I, ch. XXXIV). For Israel's sake, it descended on earth to dwell in the holy land and in the temple. Though omnipresent, the Shekinah may dwell in the smallest place. Like the sea, flooding a cave, it filled the tabernacle with its radiance (*Song of Songs Rabba* 3:10). Even when the temple was destroyed, the Shekinah remained on the ruined site and at the western wall (*Exodus Rabba* 2:2). After the destruction of the temple, the Shekinah departed to heaven. The view is also frequently expressed that it manifests itself in houses of worship and of study. Whenever 10 men gather for prayer, the Shekinah is with them. It is present also when three men hold court, when two men or even one study the Torah. Conversion to Judaism is described as coming under the wings of the Shekinah. Every act of piety and benevolence, of virtue and of truth, attracts the Shekinah, while every act of injustice and wickedness, and every manifestation of pride and sin, repels it. "Four groups do not receive the presence of the Shekinah: scoffers, hypocrites, liars and calumniators" (*Sota* 42a). Jonathan paraphrases Leviticus 9:6: "Remove the evil inclination from your heart, and at once the Shekinah will reveal itself to you." "Rab Hisda says: in the beginning before Israel sinned, the Shekinah rested upon every Israelite . . . but when Israel sinned the Shekinah departed." (*Sota* 3a).

The realization of the Shekinah is possible neither in melancholy nor in idleness, neither in levity nor in light-heartedness, but only in the joy of the fulfillment of religious duty (*Sabbath* 30b). The Shekinah rests not upon the haughty but only upon the humble. However, the opinion occurs that "the Shekinah rests only upon men who are wise, strong, rich and of tall stature" (*ibid* 92a). "A priest devoid of the holy spirit and of the Shekinah is not consulted." (*Yoma* 73b). In the conviction that God is never left without witnesses, Abaye maintained that "there never are less than 36 righteous men who daily receive the Shekinah." (*Sukka* 45b).

The Shekinah constitutes the source not only of moral and religious inspiration but also of personal consolation and comfort. In the spirit of Isaiah 63:9, the Shekinah is conceived as sharing in the sorrows and tribulations of men. It supports the sick and the afflicted. It is particularly present in the troubles of Israel. "Whithersoever Israel was exiled the Shekinah followed." Into Egypt, Babylonia, Rome, etc.

the Shekinah went with Israel, and when Israel shall return to its homeland, the Shekinah will also return (*Mekhilta*, ch. IV; *Megillah* 29a). Hence the prayer "And may our eyes behold Thy return in mercy to Zion. Blessed art Thou, O Lord, who restorest Thy Shekinah unto Zion." The radiance of the Shekinah delights the souls of the righteous in the present life and is their food in the hereafter.

While the Shekinah partly helped to safeguard the idea of God against excessive anthropomorphism and anthropopathism, it also created difficulties of its own. The luxuriant imagery in which it was clothed readily suggested to the mind a materialized and personified being. We need cite only the following from the teaching of Rabbi Aha. When the Shekinah was leaving the temple it, like a king who is forced to leave his palace, "repeatedly turned toward the walls and pillars, embracing and kissing them, and calling amid tears: Farewell, my sanctuary! Farewell, house of my sovereignty! Farewell, house of my glory! Farewell, now and forever!" (Introduction to *Lamentations, Rabba*, ch. XXV). The old anthropomorphism of the Bible was thus transferred to the Shekinah. A protest against this tendency leading to divisions in the Godhead is sounded in the Midrash Haggadol to Exodus 24:10 (S. Schechter, *Aspects of Rabbinic Theology*, p. 40).

The association of the Shekinah with the manifestation of Divine glory in light and fire naturally led to the conception of the Shekinah itself as consisting of an unearthly light, radiating a special splendor. (*Hullin* 59b-60a). Judah Halevi spoke of it as a pure and ethereal substance (*Kusari* 4:3 end). Maimonides went beyond his predecessors, conceiving of the Shekinah as a semi-independent luminous being. By excluding almost all attributes from God, he, like Philo, reduced all anthropomorphisms and anthropopathisms in the Bible to metaphor or allegory, and thus needed the Shekinah to bridge the gap between God and man. He supports his views by assuming a similar attitude in Onkelos. "All expressions denoting any mode of motion are explained by him (Onkelos) to mean the appearance or manifestation of a certain light that had been created (for the occasion), i.e., the Shekinah (Divine Presence), or Providence." (*Guide for the Perplexed*, Bk. I, ch. 27 and comp. ch. 48; see also ch. 25.) G. F. Moore correctly remarks that it does not follow that Maimonides considered the Shekinah as permanently existent, still less that he ascribed to it personality. In expressly making it a created being, "he excludes the idea of any participation in divine nature or 'essence'" (op. cit. pp. 437-8).

Nachmanides justly criticizes Maimonides's interpretation of Onkelos, adducing passages to show that Onkelos was not as actuated by the "philosophical horror" of anthropomorphism as Maimonides claims. He concludes his criticism with the remark: "Heaven forbid that the thing called *shekinah* or *kabod* (glory) be a creation outside of God as Maimonides thought." Such a conception savors of idolatry. "There are

many sayings of our Rabbis which teach that the name *Shekinah* refers to God himself blessed be He." (Com. on Genesis 46:4. See also Exodus, 20:16). Isaac Arama goes beyond Nachmanides in stripping *memra*, *yeqara* and *shekinah* of both metaphysical and Cabalistic notions, and in insisting that they are nothing more than metaphors. (*Akedat Yizhak*, Gen. ch. 31.) S. S. C.

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SHELBY, a city in North Carolina and the county seat of Cleveland Co. It is situated in a cotton growing region, 47 mi. west of Charlotte, and is served by the Seaboard Air Line and the Southern railroads. The principal industries are cottonseed oil mills, knitting mills, cotton gins and cotton mills. The retail business in 1929 amounted to \$5,434,268. It is an important and rapidly growing commercial center. Pop. 1920, 3,609; 1930, 10,789.

SHELBY, a city in Richland Co., northern Ohio, situated 12 mi. northwest of Mansfield. It is served by two railroads. Shelby is a shipping point and industrial center manufacturing chewing gum, bicycle handle bars, tubing and furniture. The city was incorporated in 1853. Pop. 1920, 5,578; 1930, 6,198.

SHELLYVILLE, a city in central Illinois, the county seat of Shelby Co. It is situated on the Kaskaskia River, 50 mi. southeast of Springfield and is served by bus and truck lines and two railroads. Corn is the chief crop of the region, and dairy farming is an important occupation. Shelbyville was founded in 1828 and made a city in 1863. Lincoln practiced law here. Pop. 1920, 3,568; 1930, 3,491.

SHELLYVILLE, a city in south central Indiana, the seat of Shelby Co., situated on the Blue River, 27 mi. southeast of Indianapolis. Two railroads serve the city, and the Nave Field, an airport, is on the outskirts of Shelbyville. The city is an industrial center, manufacturing furniture, cigars, flour, canned goods, baking-powder, gasoline engines and stoves. The retail trade amounted in 1929 to \$7,869,386. It is also a shipping point for grain and live stock. Shelbyville was laid out in 1822 and chartered as a city in 1860. Pop. 1920, 9,701; 1930, 10,618.

SHELLYVILLE, a city in southern central Tennessee, the county seat of Bedford Co., situated on Duck River, 57 mi. southeast of Nashville. Bus and truck lines and the Nashville, Chattanooga and St. Louis Railroad afford transportation. Shelbyville is surrounded by rich farming, fruit-growing and dairying country. The local manufactures include cotton products, knitted goods, rayon, slates and pencils. The city is built on a plateau, in view of the Cumberland Mountains, with their magnificent scenery, caves and medicinal springs. Shelbyville was founded in 1807; incorporated in 1819. Pop. 1920, 2,912; 1930, 5,010.

SHELDON, ARTHUR FREDERICK (1868-), American educator, was born at Vernon, Mich., May 1, 1868. He graduated at the University of Michigan in 1892 and the next year entered the publishing house of Werner Co. In 1902 he organized the Sheldon School of Business Science in Chicago, and during the next few years wrote *Science of Successful Salesmanship*, 25 vols.; *The Science of Service*, 7 vols., and *The Science of Business Building*, 32 vols.

SHELDRAKE, a genus (*Tadorna*) of handsome Old World ducks of somewhat gooselike appearance, allied to the tree ducks. The common sheldrake (*T. tadorna*) ranges from Europe to southern Siberia and Japan, wintering in Africa, India and China. It is about 2 ft. long and unlike most ducks the sexes are alike with the head and upper neck glossy green, the lower neck white and the remainder of the plumage chiefly chestnut, black and white. The bright red bill is provided at the base with a conspicuous knob. This duck feeds on seaweed and small marine animals and nests in burrows, laying 7 to 12 creamy white eggs. A smaller species (*T. radjah*), with a white head and neck and lacking the knob on the bill, occurs in New Guinea and Australia. The muddy sheldrake of temperate Europe and Asia belongs to a different group (*Casarca*) and the sexes are different. In America the name sheldrake is sometimes given to the mergansers.

SHELLAC, a resinous material, used extensively in varnishes, and produced from lac, the excretion of a small East Indian insect, *Tachardia lacca*. Shellac was first described, in 1596, by an explorer of India, J. H. von Linschoten. The lac insect, however, has been reared since very early times; it was mentioned in 250 A.D. by Aelian. Now the insect is a source of employment to thousands of people in India and, to a less extent, in Formosa, Indo-China, South East Africa and Egypt.

The young lac insects swarm twice annually. After swarming, they sink their proboscides into the twigs of certain trees, notably the bo-tree (*Ficus religiosa*), the dak (*Butea frondosa*) and the jujube (*Zizyphus Jujuba*). Their pores exude a gummy substance which, drying, forms a shell round each insect. The lac-incrusted twigs, called stick lac, are gathered in June and November. Stick lac is crushed, washed and dried, to become seed lac. Placed in canvas bags, with approximately 2-3% of arsenic sulphide, the seed lac is melted over charcoal fires. The melted lac is squeezed through the canvas, remelted and dried in slabs. These slabs are skillfully drawn into thin sheets of finished shellac.

Shellac is used in the manufacture of phonograph records, sealing wax, fireworks, electrical instruments and various other products. Shellac varnish is made by dissolving shellac in denatured 190° proof alcohol, in the proportions of 5 lbs. of shellac to 1 gal. of alcohol.

SHELLERS, machines for shelling corn. They are either of the cylinder or wheel type and are designed for both portable and stationary work. The

cylinder sheller which has the greater capacity will handle corn satisfactorily with or without the husks on the ears. The kernels are shelled off by the ears being forced between a revolving cylinder and a stationary cage surrounding it. The wheel sheller is most used for machines of the hand or small power class. The ears are shelled by being held under spring pressure against the shelling wheels. N. R. B.

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SHELLEY, MARY WOLLSTONECRAFT (1797-1851), English novelist and second wife of PERCY BYSSHE SHELLEY, was born in London, Aug. 30, 1797, the daughter of WILLIAM GODWIN and Mary Wollstonecraft Godwin. She eloped with Shelley in July, 1814, and while living in Switzerland in 1816 wrote her first novel, *FRANKENSTEIN*. It was the result of an agreement between Shelley, Byron, Dr. Polidori, Byron's physician, and herself to write a story of the supernatural. Though she was only 21 at the time her work showed great ability and was published with much success. It was followed by *Valperga*, 1823, *The Last Man*, 1826, which contains a character that is Shelley, *The Fortunes of Perkinwarbeck*, 1830, *Lodore*, 1835, and *Falkner*, 1837, and some books of travel. After Shelley's death in 1822, she returned to England from long residence on the continent, and by writing, augmented by an allowance from Sir Timothy Shelley, succeeded in educating her only surviving child, Percy. She died in London, Feb. 21, 1851.

SHELLEY, PERCY BYSSHE (1792-1822), English poet, was born at Field Place, Sussex, Aug. 4, 1792, of a good family. At Eton he resisted "fagging"; at Oxford he was expelled after a year's residence for circulating his pamphlet, *The Necessity of Atheism*. In 1811 Shelley married Harriet Westbrook, daughter of a London tavern-keeper, chiefly because he thought her unhappy at home. The idealist stands revealed; the poet made his formal entry with QUEEN MAB in 1813. It was, like the marriage with Harriet, immature. Shelley's deeper need was met by Mary Godwin (see SHELLEY, MARY WOLLSTONECRAFT); his developing genius found expression in *ALASTOR*. But he was to suffer for the bonds he had assumed. Just as his life looked brighter, because of a more adequate income and the birth of a son to Mary, Harriet committed suicide by drowning. Mary and Shelley were married; *The Revolt of Islam* appeared, confirming the advent of an authentic poet; and in 1818 the young couple went to Italy to live. The rest of his life was spent in Italy, chiefly at Pisa where his neighbor was frequently LORD BYRON. Shelley was drowned while attempting to sail his small boat, the *Ariel*, from Leghorn to Lereci, July 8, 1822. His body was cremated on the beach at Viareggio, and his heart, recovered from the flames by Capt. EDWARD JOHN TRELAWNY, was buried in the Protestant Cemetery at Rome.

Shelley's finest work was done in Italy, beginning with *Julian and Maddalo*. There he wrote his two

great dramas, the lyric *Prometheus Unbound*, uniting horror and sublimity in immortal verse and inspired by his enthusiasm for the Greek classics, and that more realistic drama, *The Cenci*, which has been called the outstanding English tragedy of the 19th century. Among the best known of his other works are *Epipsychidion*, *To a Skylark*, the flawless *Ode to the West Wind*, *The Witch of Atlas*, *The Sensitive Plant*, *ADONAI*s and the final piece of work, *The Triumph of Life*. Shelley also left a considerable body of prose, made up chiefly of political and social writings and including the unfinished *Defence of Poetry*.

During his lifetime Shelley was generally considered immoral and was regarded with but little favor as a poet. The tendency to idealize him, since his death, has grown continually, and indeed his fiery career lends itself readily to idealization. The strongest influences in his life, it is generally agreed, were the French Revolution and the classic Greek ideals. Shelley believed passionately that mankind could be regenerated, and the cry for freedom, both political and intellectual, was always on his lips. The glory he brought to English poetry was one mingled of that intellectual freedom, of lyric beauty and of mystic exaltation. See also ENGLISH LITERATURE.

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SHELL HEAPS, or kitchen middens, called by Danish archaeologists *skaldynger*, are large heaps of oyster and other shells, and containing broken bones of animals and fish mixed with flint implements and flakes, with pieces of coarse pottery, bone combs and horn axes. They are found mostly near the shores of the Kattegat or along Limfjord in Jutland. As neither polished stone implements nor bones of domesticated animals have been found in these shell heaps they are older than Neolithic (see NEOLITHIC PERIOD), but not very ancient. Some of these shell heaps are from 800 to 1000 feet long by 150 to 200 feet broad. Depressions at the top suggest the presence of huts whose inhabitants accumulated the shells from their feasts of oysters and fish. The bone combs have long teeth and short handles. There are also bone needles, pins and bodkins. The bones of deer and boars, swans, ducks and gulls and of deep-sea fish have been found in the shell heaps. See ARCHAEOLOGY.

SHELL SHOCK, a form of nervous disturbance associated with hysteria or psychasthenia and long known to medicine under other names. During the World War, soldiers developed all sorts of symptoms of hysterical character associated with the tremendous mental strain of being at the front and of being constantly under shell fire. Many of the soldiers developed tremors which were not different from those of such serious diseases as multiple sclerosis and paralysis agitans.

Some of the soldiers developed loss of sight or of

hearing, the weakness being wholly in the mind, the men being unable to hear or see because they were convinced in their own minds that they could not; when, however, by the power of suggestion they were unconvinced, they recovered the senses which they had lost. A similar condition to shell shock is traumatic neurosis, in which the individual, in association with some accident, develops a loss of some function.

In general, the shell shock may be characterized as a state of the nervous system in which there is mental depression due to wrong ideas of bodily ailments. Associated with the shell shock there may be apathy and lathargy, also temperamental moods, and a tendency to day dreaming associated with mental upset. Patients who suffered with shell shock had hallucinatory tremors of an hysterical type because of the severe fear and fright factors associated with their conditions.

The emotional upheaval of the war tended to break down control. There are associated with the breakdown disturbances of the sympathetic nervous system, including slow heart, spasms of the phloric and cordia openings of the stomach, spasms of the muscles of the gall-bladder and of the intestines, disturbances of perspiration and general weakness.

When the patient is given proper rest and diet and removed from the source of his anxiety, and given proper suggestions as to the origin of his symptoms, he is likely to recover promptly. M. F.

SHELTER TENT OR PUP TENT, a small tent to shelter two. Each soldier carries in his field equipment one half of the tent which is formed by buttoning them together. Tent poles and pins are carried in the packs. Rifles may replace poles as uprights.

SHELTON, a city in southwestern Connecticut, in Fairfield Co., on the west bank of the Housatonic River, served by the New Haven Railroad. Shelton is situated in a highly industrialized section of the State and has diversified manufactures. The retail trade in 1929 amounted to \$2,036,553. It became a city in 1917. Pop. 1920, 9,475; 1930, 10,113.

SHEM, according to the genealogical, or as some hold, the ethnological, tables in the BOOK OF GENESIS, was the eldest of the three sons of NOAH. He is the personification of the dominant Semitic peoples, especially of the Hebrews, if we adopt the thesis that he is an ethnic rather than a historic individual. The racial classification Semitic is derived from his name and was first used by Schlozer or Eichhorn to distinguish the Hebrews and allied races in southwestern Asia and eastern Africa. The reference to "the God of Shem" (9:26) is thought by some to imply that Jehovah was worshiped by races akin to the Hebrews.

SHENANDOAH, the largest city in Page Co., southwestern Iowa, situated on the Nishnabotna River, about 50 mi. southeast of Omaha, Neb. Bus lines and three railroads serve the city. The chief crop of the vicinity is corn. The city's principal industries are machine and railroad shops, mitten and stock

powder factories, flour mills, wholesale seed houses and nurseries. Shenandoah, founded in 1870, was incorporated in 1871 and 1886. Pop. 1920, 5,255; 1930, 6,502.

SHENANDOAH, a borough of Schuylkill Co., Pa., 35 mi. southwest of Wilkes-Barre; it is served by the Lehigh Valley, the Pennsylvania and the Reading railways. As part of the great Schuylkill anthracite mining region, Shenandoah has drawn people from nearly every European nation. In 1929 the value of the factory output was approximately \$2,000,000; the retail trade amounted to \$7,989,772. The town was named after Shenandoah Valley, Va. In 1835 a log house was built here, but not until 1862, when a colliery was opened, were there other settlers. The borough was incorporated in 1866. Pop. 1920, 24,726; 1930, 21,782; 20% were foreign-born.

SHENANDOAH RIVER, a headstream of the Potomac, formed by the union of its north and south branches which rise in the Allegheny Mountains in southwestern Virginia. The two forks meet at Front Royal. The Shenandoah system flows for long distances through limestone valleys, following a northeasterly course through the picturesque valley between the Blue Ridge and central Appalachian ranges, and joins the Potomac at the historic water gap of Harper's Ferry. Throughout its extent of 200 mi. it has a fall of 1,250 ft. which affords excellent water power used for milling and manufacturing. The area drained, covering about 2,850 sq. mi., is devoted to agriculture and stock raising. The important cities located within it are Staunton, Winchester, Woodstock and Harrisonburg.

The Shenandoah Valley figures prominently in history as a scene of important operations during the Civil War. Because of its fertility and the mills and factories established at that time, it was a valuable requisitioning base and for the South was a convenient recruiting region. Two separate campaigns were waged within it, the first in 1862 in which Stonewall Jackson led the Confederate troops; and the second in 1864 when Sheridan commanded the Northern army and Early the Southern.

SHENSTONE, WILLIAM (1714-63), English poet, was born in Halesowen, Nov. 1714. He was educated at Oxford and, upon inheriting the estate of Leasowes, retired there in 1745. Thenceforth he devoted himself to beautifying his property and to writing poetry. He was a prolific correspondent, and it is thought that one of his letters to THOMAS PERCY, Bishop of Dromore, suggested to the latter his idea for the *Reliques of Ancient English Poetry*. Among Shenstone's writings are *The Schoolmistress*, a *Poem in Imitation of Spenser* and *Pastoral Ballad Stanzas*. He died at Leasowes, Feb. 11, 1763.

SHENYANG, the name given in 1928 to the city in Manchuria formerly called Mukden by the Russians, and Fengtien by the Chinese.

SHE-OAK, a name applied to certain species of *Casuarina*, especially *C. equisetifolia* and *C. stricta*, more widely known as BEEFWOOD.

SHEPARD, HELEN MILLER GOULD (1868-), American philanthropist, born in New York, June 20, 1868, the eldest daughter of Jay Gould. She was educated in private schools. At an early age, she became active in philanthropic work, giving generously of her personal service and fortune. Her gifts include \$100,000 to the Federal Government during the Spanish-American War; the library building and Hall of Fame to New York University; and \$50,000 for a naval branch of the Y.M.C.A. In 1913, she married Finley J. Shepard, a railroad official.

SHEPHEARDES CALENDAR, THE, a pastoral poem by EDMUND SPENSER, made up of 12 eclogues named after the months of the year; published 1579. Influenced to a great extent by Greek and Latin pastorals, but most particularly by the French eclogues of CLÉMENT MAROT, the *Calendar* is most remarkable perhaps for the number of archaic and foreign words which it introduced into poetic diction and for the new and varied meters that it either initiated or revived. The poet himself appears in the eclogues as Colin Clout; other pastoral characters are Rosalind, Cuddy, Thenot, Willie, Thomalin, Hobbinol, Eliza, Palinode, Piers, Morrel, Perigot and Diggon Davie. Of the numerous fables scattered through the poem, the finest is perhaps that told by Thenot to Cuddy, in "December," of the Oak and the Briar.

SHEPHERD'S PURSE (*Capsella Bursa-pastoris*), a small annual of the mustard family of worldwide distribution as a weed. It grows about a foot high bearing a large rosette of variously lobed basal leaves, arrow-shaped stem leaves, small white flowers and flattened purselike pods.

SHEPPARD, MORRIS (1875-), American public official, was born in Wheatville, Tex., May 28, 1875. He received his degree in law from the University of Texas in 1897, and in 1899 established practice at Texarkana, Tex., and joined the Democratic Party. In 1902 he was elected to Congress, where he remained until 1913. In that year he was elected to the U. S. Senate and was reelected in 1918, 1924 and 1930. During this period he served on the Senate committees on commerce, irrigation and reclamation, manufactures and military affairs.

SHERARDIZING. See METAL COATINGS.

SHERATON, THOMAS (c. 1751-1806), English furniture designer, was born at Stockton-on-Tees, probably in 1751. He was a self-educated Baptist preacher and, before he took up furniture designing, wrote many books and pamphlets on theological subjects. He was always extremely poor and was embittered against society. Sheraton came to London in 1790. The following year he published the *Cabinet-Maker and Upholsterer's Drawing Book*, with 111 engravings. In 1802 appeared his *Cabinet Dictionary* with 88 engravings, and in 1804 he began the publication of the *Cabinet-Maker, Upholsterer and General Artist's Encyclopedia*. Sheraton preferred to work in fanciful and rare woods. His furniture, though light and delicate in appearance, is structurally strong and

durable. Sheraton's designs are later and more rectilinear than those of GEORGE HEPPLEWHITE which were his immediate inspiration. They correspond to Directoire and Empire rather than to Louis XVI and Adam. Sheraton died in desperate poverty, Oct. 22, 1806, at London.

SHERBORNE, a market town of about 6,500 inhabitants, situated on a hill overlooking the River Ye0, in Dorsetshire, England, 118 mi. southwest of London. Of greatest interest at Sherborne are the Bishops' Castle, now a ruin, built by Bishop Roger of Caen in the 12th century; the Castle of Sir Walter Raleigh, still standing in its handsome park, built in 1590 by Sir Walter, who lived there till 1595; the Abbey Church of St. Mary the Virgin, chiefly Norman originally, reconstructed in the Perpendicular period; and the 15th century Almshouse, mainly in the Perpendicular. Sherborne in medieval times was reputed to bring only ill-luck to its possessor.

SHERBROOKE, a city and the capital of Sherbrooke Co., a port of entry in Quebec, Canada; situated at the juncture of the Magog and St. Francis rivers, about 100 mi. east of Montreal. Manufactures of machinery, railroad supplies, tire fabric, woollens, cottons and silks are important. A French-Canadian city, Sherbrooke supports many churches, including a Catholic cathedral, and has schools, public works and the district courts. The picturesque rapids of the Magog are within city limits. Originally settled by the United Empire Loyalists in 1857, it was named for Sir John Coape Sherbrooke, governor-general of Canada, 1816-18, and incorporated in 1875. Pop. 1921, 23,515; 1931, 28,933.

SHERIDAN, PHILIP HENRY (1831-88), American soldier, was born at Albany, N.Y., Mar. 6, 1831. After graduation at the U. S. Military Academy in 1853 he served in the west until the outbreak of the Civil War, when he was appointed captain, and soon afterward quarter-master in the Union Army. In April, 1862, he received his first cavalry command as colonel of the 2nd Michigan Cavalry. In July 1862 he was appointed brigadier-general of volunteers, serving in the actions at Perryville and Stone River. At Chickamauga he attracted the notice of Gen. Grant who transferred Sheridan to the Army of the Potomac. In August 1864 Sheridan was given command of the Army of the Shenandoah, and expelled the Confederates from the valley. His army was surprised on Oct. 19 by Early at the battle of Cedar Creek, on which occasion, according to the legend, Sheridan, 20 miles distant, made his famous ride to rally his fleeing troops, although nothing of the kind appears actually to have happened. By Apr., 1865, the newly appointed major-general had placed his army directly in the Confederate line of retreat from Appomattox, and the Civil War ended. Sheridan held several commands after the war, fought in the Indian campaigns of the southwest in 1868 and in 1883 was appointed to the chief command of the United States Army. He died at Nonquitt, Mass., Aug. 5, 1888.

SHERIDAN, RICHARD BRINSLEY BUTLER (1751-1816), British dramatist and statesman, was born in Dublin, Ireland, in Sept. 1751; the son of Frances and Thomas Sheridan. As Sheridan's stay at Harrow seemed of little avail, he received private tutoring. In Bath, he fell in love with the beautiful Elizabeth Linley, daughter of the composer. He eloped and, after fighting two duels, married her in Apr. 1773. Flushed with confidence and his wife's money, Sheridan plunged ahead. He took a house near lordly Portman Square, and began living in extravagant style. His social ability enabled him to secure backing for *The Rivals*, Jan. 17, 1775. He collaborated with Linley on *The Duenna*, the great success of 1775. That year he acquired an interest in the Drury Lane Theatre, but, according to Sir Walter Scott's diary, never paid Lacy. It opened with Sheridan's version of *Vanbrugh's Relapse, A Trip to Scarborough*, Jan. 1777. *The School for Scandal* followed two months afterwards, and *The Critic* in 1779. Sheridan is the most brilliant writer of comedy in the 18th century in England. In 1780 he entered Parliament, under the protection of Fox, and filled offices in two ministries, 1782, 1783. After Fox's death, Sheridan lost power, and in 1812 his political career was ended. His extravagance was his downfall. His friends freed him from a debtor's prison, but later the once bosom companion of the Prince was slighted and ignored. He died July 7, 1816, and was buried in Westminster Abbey.

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SHERIDAN, a city in northern Wyoming, the county seat of Sheridan Co., situated at the confluence of Big and Little Goose creeks, 143 mi. southeast of Billings, Mont. The city is served by the Chicago, Burlington and Quincy Railroad. There is an airport. Sheridan is a shipping center for sub-bituminous coal, live stock and dairy products. The city has repair shops, a flour mill, iron works, a brick and tile plant, a beet-sugar factory. It has the largest zoo in Wyoming. Sheridan was laid out in 1882; incorporated in 1884. Pop. 1920, 9,175; 1930, 8,536.

SHERIFF, in English law, the principal administrative officer in each county whose duty it is to execute writs and warrants for the apprehension of offenders. He is appointed by the Crown. In the United States also the sheriff is usually the chief administrative officer of the county and is chosen by popular election. It is his duty to serve process, summon juries, execute judgments and conduct judicial sales. He is the executive arm of the Superior Courts in the county. Also he is the chief conservator of the peace.

SHERIRA GAON (10th century), a member of a prominent Jewish family, several members of which had occupied the office of Gaon in Babylonia. His literary activity was confined largely to Talmudic subjects, and while he was a master of Arabic he preferred Hebrew and Aramaic for the writing of his

works. He was a student of the mystic teachings of the Kabbalah; but his fame rests largely upon a letter he had addressed to the Jewish scholars of Kairwan, which became the primary source for the history of Talmudic and post-Talmudic traditions. In clear and lucid language, this letter throws much light on many an obscure phase of Jewish history.

SHERLOCK HOLMES, the hero of a series of detective stories by SIR ARTHUR CONAN DOYLE. He is a private detective who takes pleasure in solving insolvable mysteries, in mystifying his friend, Dr. Watson, while doing so, and in playing the violin. He first appeared in *A Study in Scarlet*, 1887, and subsequently was the chief character in *The Sign of the Four*, 1889, *The Adventures of Sherlock Holmes*, 1891, *The Memoirs of Sherlock Holmes*, 1893, *The Hound of the Baskervilles*, 1902, *The Return of Sherlock Holmes*, 1904, *His Last Bow*, 1918, and *The Case-Book of Sherlock Holmes*, 1927. The most popular detective in fiction, Sherlock Holmes has been widely imitated.

SHERMAN, JAMES SCHOOLCRAFT (1855-1912), 27th Vice-President of the United States, was born at New Hartford, N.Y., Oct. 24, 1855. He graduated from Hamilton College and began law practice at Utica in 1880. He became interested in Republican politics, and was elected Mayor of Utica for 1884-85. In 1886 he was elected to the House of Representatives, and, excepting 1891-93, served until 1908. He was chairman of the Republican National Congressional Committee in 1906. Two years later he was elected Vice-President on the ticket with Taft, but before the end of his term, died at Utica, N.Y., Oct. 30, 1912, shortly after his renomination to the office.

SHERMAN, JOHN (1823-1900), American statesman, was born in Lancaster, Ohio, May 10, 1823. He was a younger brother of Gen. William Tecumseh Sherman and was educated in the public schools and from 1835-37 at Homer Academy, Lancaster. In 1839 he acted as junior rodman for a corps of engineers who were building Ohio canals. He studied law and after his admission to the Ohio bar in 1844 began its practice in Mansfield, O. A delegate to the Whig national convention at Philadelphia in 1848 he served as secretary to the convention and was again a delegate to the Whig National Convention at Baltimore, 1852. He moved to Cleveland, O. in 1853. In 1855 he was president of the first Ohio Republican state convention.

Elected as a Republican to Congress in 1854, Sherman was thrice reelected, serving from Mar. 4, 1855 until Mar. 21, 1861, when he resigned to enter the U.S. Senate as successor to Salmon P. Chase, who had resigned to enter Lincoln's cabinet. Sherman was reelected to the Senate in 1866 and 1872. In the House of Representatives, he insisted upon governmental economy and carefully studied the finances of the nation. His last term in the House, as chairman of the committee on ways and means, he watched appropriations closely and insisted upon a

sound financial policy. In the Senate his recognized mastery of national finances led to his assignment to the Senate committee on finance of which he became chairman after the Civil War. The post was of utmost importance at the time because of the post-war controversy as to the proper government attitude toward the enormous quantity of paper money and bonds issued during the war. Sherman insisted upon the resumption of specie payment and an act for that purpose was passed in 1874. Hayes appointed Sherman Secretary of the Treasury in 1877 and in that office he supervised on Jan. 18, 1879 the resumption of specie payments for which he had struggled. He furthermore refunded the bonded debt of the United States in a manner which improved its financial condition and credit standing.

Sherman was a prominent candidate for the Republican presidential nomination in 1880 and again in 1888. In 1880 James A. Garfield, who placed Sherman's name in nomination before the convention, was both nominated and elected. From 1881-97 Sherman again served as Senator from Ohio. Always an opponent of monetary inflation, curiously the Silver Purchase Act of 1890 bore his name, since he approved it in preference to what he regarded as the inevitable alternative of free and unlimited coinage of silver. Sherman in 1893 voted for the repeal of the Silver Purchase Act. The Anti-Trust Act of 1890, which also carried his name, in its final form only slightly resembled the bill which he had originally introduced. McKinley in 1897 appointed him Secretary of State, chiefly in order that Mark Hanna might be installed in the vacated Senate seat. Sherman was now an old man with waning mental energy and the strain of the office caused his resignation in April 1898. He died in Washington, Oct. 22, 1900. S. McK.

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SHERMAN, ROGER (1721-93), American statesman, was born in Newton, Mass., Apr. 19, 1721. He moved with his parents in 1723 to Stoughton, where he later attended the district schools. Sherman was appointed surveyor of New Haven Co. in 1745 and in 1752 of Litchfield Co. In the meantime, he studied law, and was admitted to the bar in 1754.

Sherman was a member of the Connecticut Assembly 1755, 1756, 1758-61, and 1764-66. He was a justice of the peace for Litchfield Co. 1755-61, and of the quorum 1759-61. He moved to New Haven in 1761 where he was a justice of the peace and of the quorum for New Haven Co. in 1765 and 1766. He served in the state senate 1766-85 and a judge of the superior court 1766-67 and 1773-88. As one of the most prominent political figures in his colony he was a delegate to the first Continental Congress which met Sept., 1774. He was also a delegate to the second Congress (1775) and served in that body continuously until 1781 and again in 1783 and 1784. From the outset of the Continental Congress, a champion of the right of the colonies to be ruled by their local legislatures, he was appointed to many important committees, in-

cluding those which framed the Declaration of Rights (1774), the Declaration of Independence (1776), and the Articles of Confederation. He later was a member of the convention at Philadelphia in 1787 which drew up the Federal Constitution and Sherman has the distinction of being the only member of the Continental Congress who signed all four of these important state papers.

In 1783 Sherman, with an associate on the bench of the superior court, revised and codified the laws of Connecticut. At the Federal Convention at Philadelphia (1787), he introduced the so-called Connecticut Compromise whereby state representatives in the House was to be according to population and representation in the Senate was to be equal from all states. Sherman worked for the ratification of the proposed Constitution in his state and voted for it in the Connecticut Ratifying Convention (1787). He was elected to the first national House of Representatives, serving Mar. 4, 1789 to Mar. 3, 1791 and was elected to fill a vacancy in the U.S. Senate, serving from June 3, 1791 until his death. In the national legislature he generally supported the Federalist policies. In addition to his other duties, from 1784 until his death he was mayor of New Haven, Conn. He died July 23, 1793 in New Haven.

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SHERMAN, WILLIAM TECUMSEH (1820-91), American soldier, was born at Lancaster, Ohio, Feb. 8, 1820. He attended school at Lancaster until 1836 when he was appointed to West Point from which he graduated in 1840, sixth in a class of 42. He served in Florida and South Carolina and was sent to California during the Mexican War where he was not engaged in any hostilities. In 1851 he had been commissioned a brevet-captain, his rank to date from 1848, and in 1853 he resigned from the army to become the manager of a San Francisco bank. The bank suspended business in 1857 and Sherman, who had studied law, opened a law office with two others in Leavenworth, Kansas Territory. In 1859 he was elected superintendent of the Louisiana Military Academy, from which office he resigned Jan., 1861, because of the threatened secession of the state.

Sherman was commissioned colonel of the 13th U.S. Infantry, May 14, 1861. He commanded a brigade at the Battle of Bull Run, July 21, 1861 and for his meritorious service in this battle he was made a brigadier-general of volunteers, the commission to date from May 17, 1861. Sherman was appointed to command the department of Kentucky, Oct. 7, 1861 but was relieved Nov. 12 because of what were considered his extravagant estimates of the number of men which would be required to drive the Confederate forces from Kentucky. His judgment subsequently proved to be right. Early in 1862 he organized a volunteer division and commanded it with distinction and bravery although severely wounded at the Battle of Shiloh, Apr. 6-7, 1862.

General Grant, who commanded the Union forces,

recommended Sherman's promotion and May 1, 1862 he became a major-general of volunteers. Sherman was placed in charge of the department of Memphis and during the fall of 1862 and first half of the year 1863 he cooperated with his superior, Grant, in the operations against Vicksburg. Despite an unsuccessful attack which he launched against Vicksburg, Dec. 27-29, 1862, Sherman received a great deal of the credit for the ultimate Union success, at that Confederate stronghold, July 4, 1863. On that date he was made a brigadier-general of the regular army, the advantage of the seemingly lower rank being that it was a permanent commission, whereas that of major-general of volunteers would terminate with the war. Sherman was assigned to command the department of Tennessee, Oct. 18, 1863 and during that month and November he rushed his troops by strenuous marches to eastern Tennessee, where they contributed to the success of the hard-pressed Union forces at Chattanooga. He next led his weary troops north to Knoxville, Tenn., where Dec. 6, 1863 he compelled the Confederate forces to abandon the siege of the town. Sherman in Mar., 1864 succeeded Grant as commander of the division of the Mississippi and May 6, 1864 from Chattanooga he began his march on Atlanta which culminated in the capture of the town Sept. 2, 1864. He was promoted to a major-generalship of the regular army, Aug. 12, 1864.

Nov. 14, 1864 Sherman left Atlanta on his famous "march to the sea" and Dec. 25, 1864 he by telegraph presented Savannah to President Lincoln as a Christmas present. His army continued its incredibly long marches by moving northward through the Carolinas and at Durham, N.C., General Joseph Johnston's Confederate army was surrendered to General Sherman, May 24, 1865. Sherman came out of the war with a reputation for military brilliance which had been gained by consistently skilful direction for years of large armies under the most difficult circumstances of actual combat. He was twice thanked for his services by a vote of Congress. He remained in the army after the war, being promoted to a lieutenant-generalcy, July 25, 1866 and Mar. 4, 1869 became general of the army, a position which he held for 15 years. He was retired automatically by law, Feb. 8, 1884. He died in New York City, Feb. 14, 1891.

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SHERMAN, a city in Grayson Co., northeastern Texas, situated 70 mi. north of Dallas. Bus lines and six railroads serve the city. There is also an airport. Sherman is the trade center of a livestock raising region, with cotton, grain and alfalfa the chief crops. It is also a railroad and industrial center, having more than 60 factories. Cotton products, flour, candy and machinery are among the chief manufactures. In 1929 the value of the factory output was about \$12,000,000; the retail trade amounted to \$8,659,181. The city was founded in 1848, and named for General Sidney Sherman, who, at the Battle of San Jacinto, raised the battle cry, "Remember Alamo—remember Goliad." Pop. 1920, 15,031; 1930, 15,713.

SHERMAN ANTI-TRUST ACT OF 1890, an act prohibiting combinations in restraint of trade or commerce, and monopolies or attempts to monopolize trade or commerce in the fields over which Congress has jurisdiction—interstate and foreign territory—and providing penalties of fines and imprisonment for violations. Other less important sections are concerned with matters of definition and jurisdiction, but Section VII is particularly noteworthy in authorizing the recovery of triple damages and costs by any person or corporation injured by any action declared illegal by the statute.

The criminal penalties provided have been consistently ineffective and inoperative, despite severe judicial criticism of some trust magnates. The usual penalty assessed in cases where convictions were secured was the dissolution of the trust (*see* TRUSTS). Even dissolutions, however, have been of very dubious success in restoring bona fide competitive conditions.

The statute was particularly ineffective for about ten years after its passage, partly because the officials of the Department of Justice were out of sympathy with its purposes and partly because the decision of the United States Supreme Court in 1895, in the *E. C. Knight* case, was generally believed to have drawn the teeth from it. Uncertainty concerning the real meaning of the act was heightened by a difference of opinion within the Supreme Court on the exact meaning of the words "every contract . . . in restraint of trade or commerce" in Sections I and III. (*Trans-Missouri Freight Association and Joint Traffic Association cases*.) In 1899, however, the decision in the *Addyston Pipe Pool Case* made it clear that the Supreme Court had no intention of defining commerce so narrowly as had been believed after the *Knight* case. In 1904, the Northern Securities decision destroyed the widely held opinion that a New Jersey holding company charter was a guarantee of immunity from prosecution under the Sherman Act.

The decisions dissolving the oil and tobacco trust in 1911 are probably the most important ones affecting industrial combinations, since they seem to have established definitely the rule of reason in interpreting what contracts are in restraint of trade. In a word, only contracts which unreasonably restrain trade are illegal. Just exactly what contracts restraining trade the Supreme Court will hold to be reasonable, few persons would be willing to predict in advance, but in general it seems that the Supreme Court recognizes that not all restraints on competition are also restraints on trade, and that the statutory rule of reason preserves substantially the same distinctions established at common law prior to 1890. Following this line of reasoning, the Supreme Court has tended more and more to recognize certain advantages in industrial combination and to refuse to dissolve such combinations, for example, the U. S. Steel Corporation. On the other hand, it seems true that the Supreme Court still fails to realize similar advantages to be secured by joint activities of business

men and working men and has in numerous instances penalized them for actions which are permitted to outright consolidations. See also CLAYTON ACT.

C. A. G.

SHERMAN SILVER PURCHASE ACT, passed July 14, 1890, a compromise measure, sponsored by Sen. John Sherman, designed to fend off a movement for the free and unlimited coinage of silver. Congressmen from the northwestern states, where silver interests were strong, threatened to block the McKINLEY TARIFF BILL, the passage of which was greatly desired by Eastern manufacturers, unless their demands were met. The BLAND-ALLISON ACT, under which the Treasury had spent \$308,000,000 for silver bullion, 1878-90, was alleged to provide insufficient inflation. The Sherman Act called for the purchase of 4,500,000 ounces of silver each month, to be paid for with a new issue of legal-tender notes redeemable in gold or silver. President Cleveland believed that the financial depression of 1893 was largely due to the Sherman Act, as having dangerously depleted the gold reserve, and forced his party to repeal the measure, Oct. 30, 1893.

SHERMAN'S MARCH TO THE SEA, in the CIVIL WAR, the campaign of the Union army under Gen. W. T. SHERMAN, Nov. 15-Dec. 25, 1864. Refusing to be inveigled into pursuing the Confederate army into Tennessee, and so losing the benefits of his occupation of Atlanta (see FRANKLIN, BATTLE OF), Gen. Sherman with 62,000 troops set out for Savannah, after burning a considerable portion of Atlanta. His force, including the Army of the Cumberland under Gen. Slocum and the Army of the Tennessee under Gen. Howard, was ordered to advance in four parallel columns and to take its forage from the country. The various corps commanders were ordered to destroy mills, cotton gins and similar buildings, and to devastate districts which resisted the progress of the army. The march, at a steady rate of 12-15 miles a day, swept a swath of country 40-80 miles in width. Sherman exceeded his instructions. Many private houses were invaded and despoiled; 265 miles of railroad were destroyed, and foodstuffs and cotton were consistently confiscated or destroyed. The march culminated with the capture of Savannah. See SAVANNAH, BATTLE OF.

SHERIFF, ROBERT CEDRIC (1896-), English dramatist, was born at Kingston-on-Thames, June 6, 1896. After being a clerk he saw service in the World War. He wrote the plays, *Profit and Loss*, *Cornlow in the Downs*, 1923, *The Feudal System*, *Mr. Birdie's Finger*, 1926, *Journey's End*, 1928, and *Badger's Green*, 1930. *Journey's End* began with a performance at the Arts Club, London, and was produced by Maurice Browne at the Savoy Theatre, London, Jan. 1929. The success of this cross-section of war life was so pronounced that more than 20 companies were playing it in 1929-30, in America, Great Britain and on the Continent.

SHERWOOD FOREST, formerly a royal hunting preserve in Nottinghamshire, England; now

largely deforested. The great forest, which was about 25 mi. long and from 6 to 8 mi. wide, is by tradition the scene of Robin Hood's famous adventures.

SHE STOOPS TO CONQUER, a farcical comedy by OLIVER GOLDSMITH; produced 1773. It is said to be based on an incident in the author's own life. The bashful young Marlowe, accompanied by his friend Hastings, is on his way to the home of Mr. Hardcastle, whose daughter, Kate, he hopes to marry. Tony Lumpkin, a practical joker, directs the diffident youth and his friend to the Hardcastle's house, but makes them believe that it is the village inn. The Hardcastles, both family and servants, enter into the spirit of the occasion, and treat their "guests" to some extraordinary incidents. Kate, in her assumed character of inn barmaid, completely conquers Marlowe, and Hastings is rewarded in the end with the hand of Constance Neville.

SHETLAND ISLANDS, a group of islands north of Scotland and about 50 mi. northeast of Orkney, bounded by the Atlantic on the west and the North Sea on the east. There are more than 100 islands, covering an area of 352,000 acres. About one-fourth of them are inhabited, the population numbering 25,520. In general the landscape is bare and rocky, with prominent hills and cliffs. Norsemen were the first to supplant the original inhabitants and many of their customs survived after the islands became Scottish possessions with the Orkneys as part of Margaret of Norway's dowry when she married James III of Scotland. To-day the Shetlands return one member to Parliament. The best-known islands are Mainland, Yell, Unst, Walsay and Trondra. The main industries are cattle-raising, including the Shetland ponies for which the islands are famous, deep-sea fishing, whaling and the hand-weaving of tweed. Agricultural products consist principally of potatoes, turnips and grains.

SHICKSHOCK MOUNTAINS, a range of highlands on the Gaspé peninsula of Quebec, extending about 65 mi. from the east side of the Ste. Anne des Monts to the Matane. They stand on a breadth of from two to six mi., about 12 mi. from the St. Lawrence, and rise to summits of 3,000-4,000 ft. This range is a continuation of the Notre Dame Mountains and is the terminal of the Appalachian system. It forms part of the timbered wilderness of the interior of Gaspé which is noted for its scenery.

SHIDEHARA, KIJURO, BARON (1872-), Japanese statesman, born near Nara. After graduating from the Tokyo Imperial University in 1895 he entered the government service and rose steadily. In 1912 he was made embassy counsellor at Washington. He served as Minister at The Hague in 1914-15 and Ambassador to the United States in 1919-22. He held the post of Minister for Foreign Affairs in the Japanese Government from 1924-27 and again from July 1929 to Dec., 1931. Baron Shidehara has been outstanding in his advocacy of a policy of friendliness and cooperation with China and one of the leading fighters against military domination in Japan.

SHIELDING, the electrostatic and magnetic separation of radio apparatus. Either type of shielding is usually accomplished by completely surrounding the elements in question with a metal, such as copper or aluminum, which has good electrical conductivity. *See also* ELECTROSTATICS; MAGNETISM; RADIO COMMUNICATION.

SHIFTING OF TAXES. The man who pays a tax is not always the one who bears the burden. He may get his money back from some one else. Thus an importer who pays CUSTOMS DUTIES on goods brought in from a foreign country expects to get the tax back when he sells the goods.

But there is much discussion as to the possibility of shifting direct taxes. Thus at first sight it seems improbable that a poll tax could be shifted. Yet it has been argued that when wages are so low as to afford only a bare living a poll tax paid by wage workers would have to be reimbursed to them by their employers in higher wages. So too an INCOME TAX, or a property tax, both of which seem to fall in the very first instance on the ultimate bearer, may conceivably so affect the source of the income or the use of property as to be shifted. Some writers have been so impressed by this possibility as to assume that all taxes are in whole or in part shifted about from one person to another so as to be diffused through all society, everybody eventually being hit. But most writers on TAXATION hold that shifting is by no means so easy or certain. Some, at least, and often a large part of all direct taxes, fall on the man who first pays them. One of the most frequently debated questions is whether public utilities, such as railroads, can shift their taxes to their patrons in the form of higher rates. Some people say "of course they do, where else would they get the money?" But when one considers that when the rates go up fewer people travel and less freight moves, may it not be wiser for the stockholders to bear all or part of the tax than to run the risk of losing so much traffic as to get no dividends?

These problems of shifting are considered the most intricate and difficult of any relating to taxation. They are bound up with the whole problem of values, markets and prices. To illustrate, can a Kansas wheat farmer get a higher price for his wheat, merely because the school tax on his farm has been raised? The French mathematician Cournot tried to solve some of these problems and laid down formulae which are still used. C. C. P.

SHIITES, or Shi'as, members of the Moslem sect Shi'a, meaning sect, which in itself includes many parties, called variously Alids, Ismailians, Karmatians, Fatimids, etc., all of which, however, recognize Ali as the first legitimate Khalif after Mohammed. Beyond that, they have had various beliefs, and espoused various causes in opposition to the regular Sunni line of khalifs and the orthodox Sunni tradition. The Shi'ite claim for Ali is based upon his relation to Mohammed as cousin and son-in-law, having married the Prophet's daughter, Fatima. The claim is

supported by a peculiar body of *hadith* (sayings of Mohammed) in which Mohammed is made to declare Ali his successor. A common Shi'i consciousness is further established through the martyrdom at Kerbala, near Baghdad, of Husayn, the son of Ali and Fatima. This is the event celebrated annually in the Shi'a world by the Muharram rites, at the end of the month of Ramadhan. The tomb of Ali at Meshed, Persia, and the tomb of Husayn at Kerbala, are especially sacred to the Shiites. Shi'i theology is extensive and varied, including much that is mystical and rationalistic. J. C. A.

SHILLABER, BENJAMIN (1814-90), American humorist, was born at Portsmouth, N.H., July 12, 1814. In Boston he became successively editor of the *Post* and of the *Saturday Evening Gazette*. In 1840 he began the writing which, under the pen name of Mrs. Partington, became famous for its homely pungency and amusing use of English. Among Shillaber's publications are *Life and Sayings of Mrs. Partington*, *Mrs. Partington's Knitting Work* and *Wideswathe*. He died at Chelsea, Mass., Nov. 25, 1890.

SHILLING, a silver coin in England. Twenty shillings are equivalent to a POUND, and 12 pence to one shilling. Until England suspended the gold standard in the fall of 1931 the shilling was worth about 24½ cents. In Oct. 1931 it was exchanging for about 18 cents.

SHILOH or PITTSBURGH LANDING, BATTLE OF, Apr. 6-7, 1862, a bitter conflict of the CIVIL WAR, notable for its casualties. The Federal losses were 13,673 men; the Confederate, 14,687. Gen. Grant, in pursuit of the Confederate army in the West, halted at Pittsburgh Landing, on the Tennessee River near the northern boundary of Mississippi. The Confederate forces, over 40,000 men under Generals A. S. Johnston, Beauregard, Bragg, Polk and Hardee, were assembled at Corinth, Miss., about 25 miles to the south. Gen. Johnston, advised that Grant's army would shortly be reinforced by 20,000 Federal troops under Gen. Buell, determined, as his only chance to escape certain defeat, to carry the attack against Grant. At daybreak on Apr. 6 the Confederate army suddenly assaulted the Federal left wing, under Generals Sherman and Prentiss; in the desperate battle ensuing Sherman's personal courage was probably the determining factor which preserved the Union line. By darkness the Union troops had been forced back over a mile, foot by foot, and Gen. Prentiss, with 2,000 men, had been taken prisoner. The victory had been accomplished at terrific loss to the Confederates, Johnston being among the mortalities. Overnight Buell's army of 20,000 arrived, and at the renewal of hostilities in the morning Beauregard's fatigued troops were slowly driven back. In the afternoon Beauregard ordered a general retreat, and the Confederate army retired to Corinth.

SHIMONOSEKI, or AKAMAGASEKI, port on the westernmost extremity of the main island of Japan, Hondo. It is situated 4 mi. from the west

entrance of Shimonoseki Strait, which separates Hondo from the second largest Japanese Island, Kyushu. The city stretches along the foot of fortified hills, and from its position has been important both as military base and trade connection. At Shimonoseki is the terminus for railways connecting by boat with Korean ports, the Asiatic mainland and the Trans-Siberian railway. Pop. 1925, 92,317.

SHINER, a name given in the eastern United States to various small silvery fishes of the carp family (*Cyprinidae*), known also as MINNOW, DACE and BREAM. The golden shiner (*Notemigonus*) or American bream, about a foot long, with silvery sides exhibiting golden reflections, is abundant in quiet weedy waters from Nova Scotia to North Dakota and southward to Texas.

SHINGLES. See HERPES ZOSTER.

SHINGLES are made of wood, asbestos or metal. ASBESTOS shingles are very durable and suffer very little from climatic conditions. They are also fireproof, affording protection against flying sparks. Wooden shingles are made of cypress, cedar, redwood, pine and spruce; their lasting qualities being in the order in which they are mentioned. Redwood shingles are the least inflammable and, as indicated, cypress shingles are the most durable. Metal shingles are made of tin, galvanized steel, galvanized iron, zinc, or copper. They are made in many shapes and sizes but are not extensively used.

SHIN PLASTERS, fractional paper currency in denominations as low as three cents issued during the Civil War period in the United States. Congress passed a bill on July 17, 1862, authorizing the issuance of fractional paper money when silver coins had disappeared almost completely from circulation.

SHINTO, the "way" (*to*, the Chinese *tao*) of the "gods" (*shen*) of Japan, or, as the Japanese call it, *Kami-no-michi*, "the Way of the Gods." This is Japan's original, national religion which sprang up spontaneously, and is of the very structure and processes of the Japanese mind. It had no founder; its beginnings are immemorial; it is the "spirit" of Japan, whose essence is *kokutai*, or "the national genius." As such, Shinto is a cult of loyalty and a religion of patriotism. In this broad sense all Japanese are Shintoists, for all are imbued with love of country and exalt their emperor as the true symbol and object of loyalty. He, by tradition, is descended from the Sun Goddess, the supreme figure in Shinto. In a restricted sense, there are about 17,000,000, only, of Shintoists. These are members of various sects as distinct from State or Shrine Shinto. In still another sense there is a domestic cult of Shinto, with its "god-shelf," *kami-dana*, in each household, on which stand tablets or strips of paper inscribed with the names of special deities, such as the Sun Goddess, Food Goddess, or the god of a particular locality or occupation. Or, there may be a small shrine, *miya*, containing a divine "presence," *mitama*, along with pieces of sacred rice-straw, charms, etc., before which worship is performed, as before the *kami-dana*.

Sectarian Shinto, claiming altogether among its 13 divisions 17,000,000, began in the 18th century. It represents Shinto as "religion," as distinct from the State cult represented by national shrines (Ise, Kidzuki, etc.), and government custodians. In 1871 the Japanese government drew the line officially between political Shinto and the religious sects. This made it necessary for the sects to establish their own headquarters, maintain preaching halls, and support their own priesthood, although they might, along with all Japanese, resort to the national shrines on occasion. The most notable sects are those called Kurozumikyō, "sect of Kurozumi" (1780), the son of a Shinto priest in charge of a temple of the Sun Goddess. He gave his thought to Shinto and BUDDHISM, but was "cured" by the Sun Goddess of an "incurable" malady, and devoted himself to her. The best days of this sect are past. Tenri-kyō, "heavenly-reason-teaching," on the other hand claims 2,000,000 adherents, and the Taisha-kyō, "Great Shrine sect," claims four and one-third millions. All the sects have arisen out of peculiar circumstances, often the remarkable experiences of their founders. Their membership has been made up of the humbler folk, and it is a serious question how long this phase of Shinto can survive among the literate people of progressive Japan. In contrast, there has been, since the Enthronement Exercises of 1928, a revival of State Shinto, which has contributed to the lively activity which now engages Buddhists, Shintoists and Christians in Japan. J. C. A.

BIBLIOGRAPHY.—W. G. Aston, *Shinto, the Way of the Gods*, 1905; T. Harada, *The Faith of Japan*, 1914; G. Kato, *A Study of Shinto*, 1926.

SHIPBUILDING. Whatever the type of craft whether motor boat or Atlantic liner (see SHIPS, TYPES OF) the same terms are used as keel, frame, beam, deck, bulkhead and many others. However, there are two classes of construction, viz., the transverse system and the longitudinal. In the former, which is more common, there are a large number of small transverse frames closely spaced, fastened together by fore and aft members as keelsons, longitudinals, and side stringers. In the longitudinal system, there are large transverse frames spaced several feet apart, connected by brackets to structural shapes running fore and aft. This system has been extensively used in tankers, that is, vessels designed to carry oil in bulk.

The practice in different shipyards varies, and the construction outlined below is in general followed in the building of a transverse framed cargo steamer, larger vessels naturally calling for more plans and greater detail.

The dimensions, length, breadth, depth, and others decided on, calculations for displacement and stability (see NAVAL ARCHITECTURE) having been made, the arrangement plans approved by the owner, and the classification society (see SHIP CLASSIFICATION) selected, the lines consisting of profile, half breadth and body plan with an offset table are sent to the mold loft. Here the lines are laid down on the floor full size and paired. By so doing, the loftsmen can readily note

and correct any unfairness in the lines, which the office draftsman in his small scale drawing could not detect. The floor of the loft must be of seasoned wood, smooth and suitable for drawing on with a large flat lead pencil, sharpened to a chisel edge.

In the meantime, work in the drawing office is being actively pushed. Structural plans as keel, keelsons, bulkheads, and others are roughed out so plates, shapes, rivets and heavy forgings and castings, as stem and sternpost, can be ordered. A wood model of the hull to a convenient scale is made from which the shell plating is ordered, and very often one is also made of the inner bottom or tank top. On the hull model is drawn in ink the frames, the fore and aft seams of the shell plating, the location of the butts, and also lines showing the decks, side keelsons, bilge keels and other parts fastened to the shell.

After the lines have been laid down and paired in the mold loft, molds and frame levels are made to which the frames are bent. Also in the loft, or rather in space adjustment to the mold loft floor, a variety of templates, molds, battens with spacing of rivet holes are made, which are used by the angle smith and furnace men to shape the structural parts of the ship, which latter are assembled and erected on the building ways by shipfitters and erectors. Before erection the shapes and plates are taken to the plate shop, where they are punched, sheared and in some cases planed to the required size. Often it is necessary to shape them, which if it cannot be done cold by power rolls or by a bending machine, they are placed in a furnace, heated and the desired curvature put in while hot.

The ship is built on a building way. The ground on which the keel blocks are laid, must be firm, piles having previously been driven if necessary. The keel is first laid, then are placed in position the center keelson, frames, floors, and other parts. Small bulkheads may be assembled completely on the ground, picked up by the overhead crane running over the building way, and dropped into their proper place. As the parts are assembled they are bolted together and later riveted or welded. It is the practice to do all the riveting possible on the ground by machine, prior to erecting, so the minimum amount of hand riveting is done by riveters on the scaffolding. Such parts as the shell plating are of course riveted in place. After the parts are riveted, all water and oil tight seams, buttstraps and angles are caulked. The delivery of the materials to the yard, their fabricating and assembling are all planned by the production department, so that the work proceeds in an orderly manner.

Welding in many places instead of riveting is being allowed by the classification societies. Welded barges and also small steamers have been built, while warships recently built have many parts welded, which at one time were riveted.

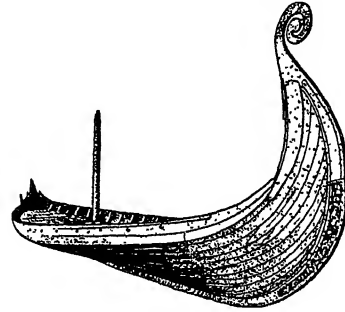
C. H. HU.

BIBLIOGRAPHY.—J. H. Biles, *Design & Construction of Ships*; A. C. Holmes, *Practical Shipbuilding*; T. Walton, *Steel Ships*.

SHIPBUILDING, HISTORY OF. From time immemorial men have worked on ways for transport-

ing themselves and possessions on water. Such included, at first, the building of rafts of logs and reeds, and the hollowing out of logs into canoes.

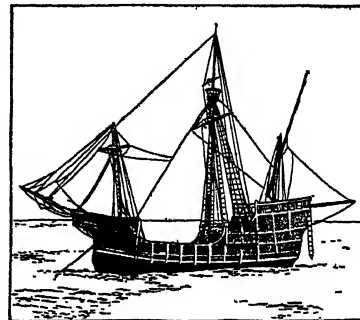
From stone carvings and paintings estimated as over 4000 years old, the Egyptians had open boats propelled by rowers, and at later dates it is known that the Trojans, Phoenicians, Greeks and Romans had large fleets which were engaged in commerce, and



VIKING BARK DISCOVERED AT OSEBERG
IN 1893

also in fighting and in transporting troops. The Romans developed the galley to a high stage, for not only were the galleys decked over, but the larger ones had two tiers of rowers, besides a mast with sail. Mention should also be made of the Norsemen or Vikings, who in their open boats, noticeable by the large figure at the stem, were propelled by oars, and also by a large square sail. The Vikings in their boats, not only visited England, France and Northern Italy, but explored Iceland, Greenland and the coast of New England.

From the days of the galley to those of Columbus, a few centuries later, many improvements were made



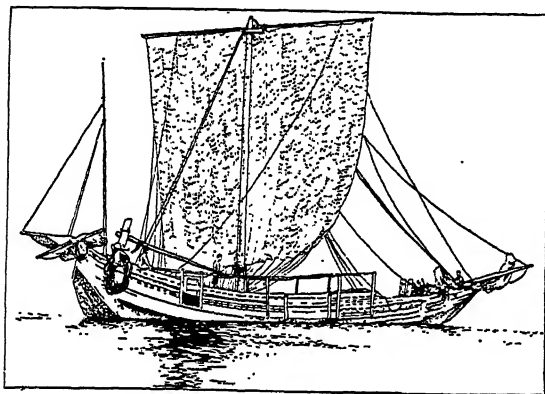
THE "PINTA," ONE OF THE THREE VESSELS
WITH WHICH COLUMBUS CROSSED
THE OCEAN

in ship construction. The ships were larger, had decks and quarters protected from the weather, while aft a high structure, called a Poop, was built for the captain and officers. Furthermore, instead of depending on oars, vessels were propelled entirely by sails, both square and triangular, which were carried on two or three masts.

For the next 400 years from Columbus's time, the

sizes of ships steadily increased and they were built stronger and more seaworthy. Long voyages sometimes of a year or more were made by explorers as Cook, Magellen, Vasco da Gama and others. Stories of the lands visited created a desire to travel by water. Furthermore, the intense rivalry of England, France and Spain for control of the sea, and later the REVOLUTIONARY WAR, the Napoleonic Wars and the WAR OF 1812—all lead to keen competition in the building of ships and consequently improved design, with finer lines, two or more decks for carrying guns and three or four masts. Of the famous warships of this period can be mentioned the Constitution (Old Ironsides) of the United States, and the Victory of England.

The next important step was the use of steam power instead of sail for propelling vessels. This followed rapidly after the building of the Charlotte Dundas in Scotland in 1801, the Clermont in 1807 by ROBERT FULTON in the United States, and many other vessels, which showed the feasibility of steam propeller



JAPANESE JUNK

vessels. As time went on, the sizes of vessels and propelling machinery increased, the hulls were built of iron instead of wood, reaching a climax in the Great Eastern, work on which was started in 1851 and finished several years later. The Great Eastern, propelled by paddle wheels and screw propellers, as well as sails, was not a commercial success, although she was used in laying the first Atlantic cable. Mention should be made of the CLIPPER SHIPS built from about 1840 to 1869, which brought tea and other products from the Far East to England and United States ports. One of the most famous of the clipper ships was the Red Jacket.

Perhaps more progress has been made in shipbuilding from the Great Eastern days to those of the present than during any other period. This can be laid very largely to improvements in marine propulsion, passing through the stages of paddle wheels, steam engines, turbines, geared turbines, Diesel engines (motors) to electric drive, consisting of a direct connected steam turbine and generator furnishing the current to an electric motor for driving the vessel. Among the well-known vessels driven by turbines

may be mentioned the Aquitania of the Cunard Line, Bremen and Europa of the North German Lloyd, of the geared turbine many cargo ships and torpedo boat destroyers, of Diesel engines the Vulcania of the Italian Line, and of electric drive several of the largest United States warships, besides many large passenger vessels as the President Hoover of the Dollar Line.

The above brief review covers only vessels navigating on the surface, but for many years inventors have endeavored to design and build craft that could navigate below the surface of the water. Particular mention should be made of those designed by John Holland in about 1900, and from his crude submarines and those of other pioneer builders have been developed SUBMARINES capable of traveling at high speeds both on the surface and below. C. H. Hu.

BIBLIOGRAPHY.—R. S. Holland, *Historic Ships*; E. K. Chatterton, *Romance of the Ship*.

SHIPBUILDING SLIP, a "berth" or *building way* substructure which supports a ship while it is being constructed; it includes the "ground ways" upon which the ship is launched; materials handling equipment; material storage areas; tracks and roadways; also power, lighting and water services. In addition to these fixed facilities, the construction and launching of a ship requires blocking, shoring, staging, sliding ways, "poppets," and other movable features.

Launching ways are usually built on an incline to facilitate launching when the ship is transferred, by wedging, from the "fixed" ways to the "sliding" ways which rest upon the lubricated ground ways.

Shallow, flat DRY DOCKS sometimes have been substituted for launching ways. Other slips, with inclines, are provided with lock gates to shorten ways and permit construction at a lower level. F. R. H.

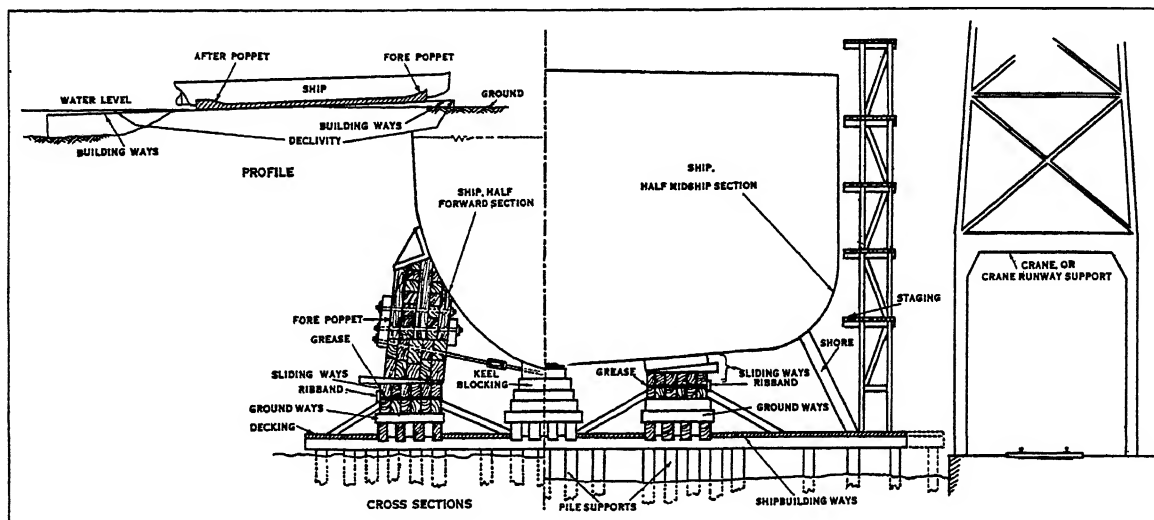
BIBLIOGRAPHY.—M. Merriman, *American Civil Engineers' Handbooks*, 1930.

SHIP CLASSIFICATION is a guarantee that a ship has been built to rules of a recognized classification society as Lloyd's in Great Britain, and American Bureau of Shipping in United States, both societies having branch offices in all important sea ports. Besides these two societies there are, Bureau Veritas in France, Norske Veritas in Norway and Registre Nazionale Italiano in Italy.

There are various classification ratings, each having different requirements. For example, for a vessel to be given the highest class by Lloyd's or American Bureau of Shipping, it is necessary that the societies' rules for the sizes of plates, structural shapes, and rivets be followed, the detail hull plans prepared by the shipyard be submitted for approval, as also various matters pertaining to the machinery. Furthermore, at the yard where the vessel will be built, the society assigns inspectors whose duty is to see that the vessel is being built according to the plans approved by the society, and that the workmanship is good. The general dimensions and class of a vessel are given in the register book published by the society under whose supervision she was built.

Motor boats, small pleasure and commercial craft are not built to the rules of any classification society, but all vessels running on coastwise passenger and freight routes, as well as those on long distance ocean routes, must be built under the rules of a classification society, for otherwise it would be impossible to get the vessel and her cargo insured. Warships designed and built under the supervision of a Government department, as the Navy Department in the

SHIPPING, HISTORY OF. The history of shipping, or the transporting of goods by water, is closely allied to that of shipbuilding (*see* SHIPBUILDING, HISTORY OF), for shipping may be said to be the use of ships. It is difficult to state whether the first vessels were employed for commercial or war purposes, and consequently the history of early shipping may be obtained from reading the exploits of the Trojans, Phoenicians, Greeks, Romans and Norsemen.



SHIPBUILDING SLIP
Upper left, side view of ship on the building ways. Center, half cross-sections of forward and midship portions

United States, and Admiralty in Great Britain are not classed by any society.

BIBLIOGRAPHY.—American Bureau of Shipping Rules; Lloyd's Rules.

SHIP INSPECTION. Ships classed by a classification society (*see* SHIP CLASSIFICATION) must be inspected periodically by surveyors of the society, to see if the vessel is kept up to her class, and if not the owner is requested to make repairs as necessary, otherwise the vessel is removed from her class by the society.

Besides the surveys made by the classification society, the United States Steamboat Inspection Service also requires periodical surveys made pertaining to its rules. It is generally arranged whenever possible that the classification society and Steamboat Inspection Service inspections be made at the same time.

These joint inspections, often lasting three or four days, cover such items as docking the vessel, examining her underwater body for pitted plates, leaky buttstraps, seams and rivets, drawing the propeller shaft and noting the extent of wear of liner and stern bushing, if liner is loose or cracked or is badly worn the shaft must be replaced, also examining life preservers and various equipment. Parts condemned by the inspectors must be replaced by the ship owner and, in some cases, the sailing of the ship is cancelled until the repairs are made.

BIBLIOGRAPHY.—American Bureau of Shipping Rules.

The discoveries and conquests by men as Columbus, Pizarro, and Cortez, and the countries claimed by them for Spain in America, brought riches to Spain and stimulated the building and sailing of merchant vessels, particularly of the class known as galleons. England through Drake, Cook, Raleigh and others who had either sailed around the world or had established colonies in North America, recognized the importance of a large merchant fleet, and various laws were passed to encourage the building of ships, for as early as 1599 companies were chartered for engaging in foreign trade as the East India Co. and the Guinea Co. The Dutch had also been active, as in the herring fishery in the North Sea, in the East Indies, in Guinea and in New York.

During the next 300 years the sizes of vessels were increased, trade routes became better established from England to America, India and Australia, and also from Portugal and France to Africa and the Far East. But the most important step in the developing of shipping was the marine steam engine, which has eventually replaced sail as means for propelling ships.

Countries, such as Great Britain, appreciated the advantage of encouraging shipping and subsidies were given to companies for carrying mail. As early as 1839, a subsidy for maintaining a service between Liverpool and Halifax, the latter port being superseded by New York, was granted to Samuel Cunard, the founder of the present Cunard Line. The Peninsular Co., which

was eventually changed to the Peninsular and Oriental Co., running to India and Australia was granted a subsidy by England, as also the Royal West India Mail Steam Packet Co. for carrying mails to South America. Other European countries as Germany, France and Italy have either granted subsidies, or made favorable concessions to run ships under their respective flags.

The United States at various times has granted subsidies to companies as the Collins Line in 1848, later to Pacific Mail S.S. Co., and New York and Rio Janeiro Co., but none of these lines were successful and all eventually went out of business. To encourage shipping, attempts have been made by Congress as the Ocean Marine Act of 1891, which unfortunately was offset by the La Follette Seamen's Act of 1915. Five years later the Merchant Marine Act was passed, and this was further modified in 1928, by extending the loans granted to steamship companies to 20 years, increasing the mail compensation and enlarging the fund available for ship construction to \$250,000,000.

Mention should be made of the activities of the U.S. Shipping Board—Emergency Fleet Corporation, which was organized by the United States Government during the World War, to build and operate ships for carrying supplies to the Allies in France. Over 1,000 ocean-going cargo vessels were built, besides many passenger ships, tug boats, lighters and even floating docks. This organization doubtless handled the largest shipbuilding program ever undertaken by any nation. At the end of the War, many of the vessels were sold to private companies, and steps taken to liquidate its holdings.

BIBLIOGRAPHY.—E. K. Chatterton, *Romance of the Ship*; C. E. Cartwright, *Tale of Our Merchant Ships*.

SHIPPING, WAR LOSSES OF. Because of late entry into the World War and remoteness from the waters where the heaviest fighting occurred the United States experienced less shipping losses during the conflict than did the other great powers. From 1917 to the close of the War the United States lost 134 vessels representing a total of 341,395 tons, while Great Britain, which suffered the heaviest, lost 3,154 vessels, totalling 7,830,855 tons. Norway, a neutral nation, suffered the second largest shipping losses while France and Italy followed with 899,357 tons and 846,389 tons respectively. The other allied nations together lost 613,000 tons while losses of the neutral nations totalled 2,320,000 tons. The total losses for the world, exclusive of the enemy nations, were 12,850,800 tons, and to this must be added the losses due to marine risks which represented 2,100,000 tons and make a grand total of 14,950,800 tons. These losses of the Allies and neutral nations were partly compensated for by 2,410,000 tons of shipping captured from the enemy. The net gain to the United States from this was 4,196,000 tons, or 128% over the tonnage of 1914. During the War the current losses were greater than the production of new ships except for the last nine months, and by the end of 1918 every nation except the United States and Japan possessed fewer ships than they did at the beginning

of the War. The losses were caused by enemy submarines, mines, war ships and aircraft. Of these losses 87% were from submarines, warships destroyed 191 vessels representing 563,000 tons, while losses from aircraft were small. Mines claimed 119 vessels averaging over 500 tons during the 21 months of unrestricted campaign. The tonnage lost by the United States due to marine risks was 302,000 tons, that by Great Britain 1,100,000 tons and by Norway 132,000 tons.

SHIPPING BOARD, UNITED STATES, a board created in 1916 by act of Congress as an independent commission to develop a naval auxiliary and merchant marine, and regulate carriers by water in foreign and interstate commerce of the United States. Its quasi-judicial powers extend over rates, fares, charges and practices, except in interstate commerce or where its jurisdiction would conflict with the Interstate Commerce Commission (*see* INTERSTATE COMMERCE ACT). Approval by the Shipping Board may exempt carriers from the restrictions of the anti-trust laws. The Board may organize corporations in the District of Columbia for the purchase, operation, lease or sale of merchant vessels. The Merchant Marine Act of 1920 further amplified the powers of the Shipping Board, which was increased from five to seven members from designated sections of the country. The establishment of steamship lines was to be encouraged, ports developed and vessels kept reconditioned until sold. The Board might itself operate such enterprises until suitable conditions of sale could be arranged.

S. C. W.

BIBLIOGRAPHY.—*Report of the United States Shipping Board, 1931; Congressional Directory, 1931.*

SHIPPING ROUTES. Below is briefly outlined by countries, their important ocean steamship lines and the routes run on.

United States. Matson Line from San Francisco to Honolulu; Pago Pago, Fiji Islands to Auckland, New Zealand, and then to Sydney, Australia. This company also maintains a coastwise service between San Francisco and Los Angeles, and from the latter city operates the Lassco Line to Honolulu.

Dollar Steamship Co. of San Francisco, Cal., operates a round the world service of 26,000 nautical miles, with sailings every week calling at Honolulu, Kobe, Shanghai, Hong Kong, Manila, Colombo, Suez, Naples, Marseilles, New York, Havana, Cristobal, Los Angeles and other ports.

American Scantic Line, New York, a weekly passenger service to Northern Europe calling at Copenhagen, Stockholm, Danzig and Leningrad.

American Export Line, New York, passenger and freight steamers to Mediterranean and Black Sea ports.

International Mercantile Marine and its affiliated companies maintains a service from New York and other North Atlantic ports to ports in Great Britain, France and Germany, also operates the Roosevelt Line to Australia, and the Panama Pacific Line from New York to San Francisco.

SHIPPING ROUTES—SHIPS

Munson Steamship Co. runs vessels between North Atlantic ports, and Rio Janeiro and others on the east coast of South America.

Barber Steamship Lines from North Atlantic ports to south and east Africa, from North Atlantic ports to west Africa, and a service to the Far East.

Germany. North German Lloyd from Bremen, Germany, to New York, Boston, Galveston, San Francisco and Portland. Also to Cuba, Mexico, West Indies, Brazil, Argentina, Chile, Australia, Africa, India, China and Japan, besides a service to England and various European countries.

Hamburg American Co. operates in the North Atlantic, and is interested in lines to Africa and South America.

Great Britain. Cunard Line, besides maintaining a service to United States, is also interested in lines to Australia and South Africa.

Royal Mail Steam Packet Co. to West Indies, South America and North Pacific.

Peninsular and Oriental Co. services to Indian and Australian ports, and to the east coast of Africa.

Alfred Holt Lines (Blue Funnel) to Far East and Australia.

Furness, Withy Co. operates subsidiary companies not only to Canada and United States, but also to South American countries.

Ellerman Line is interested in many companies, and runs steamers all over the world.

Japan. Nippon Yusen Kaisha Line (Japan Mail) from Yokohama, Japan, to Seattle, and to San Francisco and Los Angeles via Honolulu. Also to Australia and via Hong Kong, Singapore, Colombo to Mediterranean ports, and to England, Holland and Germany. Many steamers serve Korea and China.

The Osaka Shosen Kaisha maintains a world wide service.

France. French Line from Havre, to New York, New Orleans and North Pacific ports; and its subsidiaries Messageries Maritimes from Marseilles to China, east coast of Africa and Australia, and Chargeurs Réunis from Bordeaux to South America and west coast of Africa.

Fabre Line from Marseilles to New York and Mediterranean ports.

Spain. Spanish Line operating vessels between New York and Cadiz and Barcelona.

Canada. Canadian Pacific R.R. Steamship Dept. operates the famous "Empress" steamers, which on the Pacific Ocean run from Vancouver, B.C., to Honolulu, Yokohama, Kobe, Hong Kong and Manila. On the Atlantic Ocean, the terminal ports are Montreal, Quebec, or Saint John, depending on the season of the year, and a service is maintained to Ireland, Scotland, England, France, Holland and Germany.

Canadian-Australian Royal Mail Line from Vancouver via Honolulu to Auckland, New Zealand and Sydney, Australia.

Italy. The Italian Line, with its home port at Genoa, Italy, runs a passenger service to New York and other ports in North, Central and South America.

In this line were merged the Cosulich, Lloyd Sabaudo, and the Navigazione Generale Italiana. A subsidiary company, the Lloyd Triestino, maintains services from Trieste to Egypt, Greece, Turkey, the Holy Land, India and the Far East. The Adriatica line, also a subsidiary, runs ships to Malta, Naples and to Adriatic and Mediterranean ports. The *Conte di Savoia* and the *Rex*, which were both put into service in 1932, are the finest ships of the Italian Line.

Scandinavia. Swedish American Line from New York to Halifax and Göteborg.

Norwegian American Line from New York to Trondheim, Bergen, Stavanger, Kristiansand and Oslo.

Scandinavian-American Line from New York to Kristiansand, Oslo and Copenhagen.

The Netherlands. Holland America Line from New York to Plymouth, Bologne and Rotterdam.

SHIPPING TERMINALS are essential parts of waterway transportation systems and the greater part of transportation costs is incurred at such points. Features of the efficient marine terminal are: water space for the "berthing" of shipping; WHARVES; covered and uncovered shore space for the handling of goods and passengers; warehouse and open storage facilities for goods; rail and highway connections; arrangements and mechanical facilities for the economic handling and interchange of goods. At some terminals an additional feature is space for manufacturing, storage and transportation of raw materials and products. See also RIVER IMPROVEMENTS; WATERWAYS; PORTS.

BIBLIOGRAPHY.—R. S. MacElwee, *Ports and Terminal Facilities*, 1926; R. S. MacElwee and T. R. Taylor, *Wharf Management, Stevedoring, Storage*, 1921.

SHIPS, TYPES OF. Ships are of many and varied types, but may be broadly divided into two classes: those driven by sails and those by power, as with steam or Diesel engines, and turbines.

In the sail class are the following types: Bark, a sailing vessel with three masts, the fore and main masts square rigged and the mizzen mast schooner rigged. A barkentine has three masts, the foremast square rigged, and the main and mizzen masts schooner rigged. A brig has two masts, with square sails on both, while a brigantine has the same rig except the main sail is a fore and aft sail. Schooners have two or more masts, with fore and aft sails. A full rigged sailing ship has three masts (fore, main and mizzen masts), with all square sails. See also CLIPPER SHIP.

In the power class, for coastwise service, particularly on overnight runs, the vessels generally have a large house amidships for passengers, and two masts with booms for handling cargo. Ports are cut in the sides, so cargo can be readily loaded and discharged. This type is steam driven with the machinery amidships.

Next is the cargo or tramp ship, strongly built and designed for engaging in overseas trade. These vessels usually have a forecastle forward, house amidships with engineer's rooms and galley, and poop aft; the

type just mentioned is usually known as the "three island type." There are two masts fitted with booms, and sometimes king posts with booms also—all laid out so cargo can be quickly loaded and discharged. Cargo vessels have speeds of about 12 knots per hour although the current trend is to increase this speed. Steam engines with a moderate steam pressure are being superseded by geared turbines using high pressure superheated steam, and by Diesel engines.

For carrying oil in bulk, a distinctive type, known as a tanker, has been designed. This type has the machinery located aft, the space forward being used for carrying oil. A little forward of amidships is a house where are the captain's and officers' quarters, and where are installed the pumps for handling the oil, or they may be installed aft, just forward of the machinery space.

Rivalry as to luxurious accommodations and speed in passenger vessels (or liners as they are called on the North Atlantic routes) is particularly keen between companies engaged in the North Atlantic trade, North Pacific and in the various routes to South America. In general, the latest types have straight stems, cruiser sterns, two small masts and several decks with large areas given over to recreation purposes. The propelling machinery is located amidships, consisting of high pressure water tube boilers furnishing superheated steam to turbines, or instead of steam units, Diesel engines are installed.

Motor ship is a term applied to large pleasure and commercial vessels, driven by Diesel engines. Cargo motor ships are engaged on such runs as between New York and Australia, while others carrying passengers run between New York and Bermuda, and also to various European ports. One of the latest is the Britannic of the White Star Line, which is the largest motor ship of the cabin class, being 680 ft. long, and is driven by two Diesel engines (motors) of 10,000 hp. each.

Trawlers are small strongly built steel vessels, with machinery aft, used for catching fish in the North Sea, Europe. A typical trawler is about 130 ft. long, with a single Scotch boiler furnishing steam to a compound or triple expansion engine.

Ferryboats for carrying passengers and freight across a river, lake or bay, are often of steel, with water tube boilers, twin compound reciprocating engines driving propellers at each end. Ferryboats driven by Diesel engines have been built. The present trend is away from slow speed paddle wheel engines, which at one time were exclusively used, to high pressure steam reciprocating engines, turbine electric units and Diesel engines.

In the class, warships, is included battleships, carrying the heaviest caliber guns, airplane carriers, scout cruisers, torpedo boat destroyers, submarines, and miscellaneous supply and repair ships, which carry guns. See *also* SHIPPING, HISTORY OF; SHIPBUILDING; RIGGING. C. H. HU.

BIBLIOGRAPHY.—A. C. Hardy, *Merchant Ship Types*; W. Hovgaard, *General Design of Warships*.

SHIP'S LIGHTS. A vessel is required by law to carry and have lighted at night certain lights. For instance, on the starboard side a green light, on the port a red and others, depending on whether she is underway or anchored. The lights carried and their location on vessels sailing under the United States flag are specified by rules published by the Department of Commerce.

BIBLIOGRAPHY.—*Rules to Prevent Collisions of Vessels at Sea*, Department of Commerce.

SHIP'S PAPERS, documents pertaining to the ship, as her register tonnage measurement. See DOCUMENTING VESSELS. They are usually kept in a safe in the pilot house or in the captain's quarters.

SHIP TERMS commonly used pertaining to the carrying capacity or tonnage are briefly outlined below.

Gross tonnage, the capacity of the spaces within the frames or ceiling of the hull of a vessel and of the closed-in spaces above deck available for cargo, stores, passengers or crew with certain specified exemptions, expressed in tons of 100 cu. ft.

Net or register tonnage is the remained after deducting from the gross tonnage the spaces occupied by the propelling machinery (including allowances for fuel), crew's quarters, master's cabin and navigation spaces.

Cubic capacity cargo space is the cubic capacity of the cargo holds calculated to the molded lines.

Cubic capacity grain measurement is the space available for carrying grain, and is generally calculated two ins. inside of the molded lines.

Cubic capacity bale measurement is the space available for carrying cotton bales, and is usually calculated to the inboard flange of the reverse frames and to the bottom of the deck beams. See *also* DISPLACEMENT.

BIBLIOGRAPHY.—*Merchant Vessels of the United States*, Bureau of Navigation, Washington, D.C.

SHIP WIRELESS for radio communication, capable of transmitting and receiving messages over a distance of at least 100 miles must be installed on every United States' steamer navigating the ocean or the Great Lakes, that is licensed to carry 50 or more persons.

The antenna for the wireless usually extends between the two masts of a vessel, with wires to the wireless operator's room, which is generally aft or near the pilot house. See RADIO COMMUNICATION.

BIBLIOGRAPHY.—*Rules and Regulations*, U.S. Steamboat Inspection Service.

SHIPWORM. See TEREDO.

SHIPYARDS, enclosures where ships are built or repaired. Shipyard should have both land and water areas; berths, slips, wharves, quays or piers for laying up, repair and fitting out; facilities for taking ships out of water, i.e., graving or floating docks, marine railways; foundries; structural, machine, wood-working and paint shops; material handling equipment; tracks and roads. See *also* SHIPBUILDING SLIPS; DOCKS.

BIBLIOGRAPHY.—A. W. Carmichael, *Practical Ship Production*, 1919.

SHIRAZ, a city of Persia and capital of the Fars province, situated about 111 mi. from the Persian Gulf. Founded in the 7th century, it became a residence of the Persian princes. Kerim Khan made it the capital of Persia in 1760. In the 19th century the city suffered from repeated earthquakes and was at one time, in 1835, entirely laid waste. It was restored, though not on the same resplendent scale. Surrounded by walls, Shiraz contains many beautiful mosques, bazaars and a citadel. A potent wine produced in the district is famous over all Asia. Besides being the center of a large rug industry, the town manufactures glass, inlay work, silk-floss and shawls. Est. pop. 1930, 35,000.

SHIRE, originally a territorial division in Anglo-Saxon England ruled by an Ealdorman. In modern English usage it is synonymous with COUNTY.

SHIRLEY, JAMES (1596-1666), English dramatist, was born in London, Sept. 13, 1596, and entered the Merchant Taylors' School in 1608, afterwards attending Oxford and Cambridge. He became Master of St. Albans and, taking orders, obtained a living there, but resigned on joining the Church of Rome. In 1625 his success in writing plays soon made him the rival of PHILIP MASSINGER. Going to Dublin, 1631, Shirley wrote 12 plays, including the comedy, *The Lady of Pleasure*. He was held up as a pattern to his fellow poets for his "cleanly way of poetry." Returning to London, Shirley and his wife escaped the great fire only to die of exposure, and were buried together in St. Giles in the Fields, Oct. 29, 1666.

SHIRREFF, EMILY ANNE ELIZA (1814-97), English pioneer educator of women, was born Nov. 3, 1814. Early in life she became concerned about the deficiencies in the education of women and made efforts to improve this condition. She was connected with the founding of Girton College, Cambridge, in 1869, and established a Froebel Society to promote Froebel's ideas on education. Her educational publications include *Intellectual Education and Its Influence on the Character and Happiness of Women*. She died in London, Mar. 20, 1897.

SHISHALDIN, MOUNT, an active volcano on Unimak, one of the eastern Aleutian Islands, off southern Alaska. The cone is about 9,000 ft. high and was first ascended by the Rev. Bernard R. Hubbard, of Santa Clara University, who reached the summit with two companions in May 1932.

SHOCK ABSORBER, an auxiliary device attached to the frame and to the axles of a MOTOR VEHICLE to dampen the effect of spring action and rebound, and make for ease of riding. By means of friction, or of "dash pot" action the effect of road shocks is minimized or eliminated. Shock absorbers are also used on the landing gear of an airplane to minimize or eliminate the shocks of landing and those of "taking off." They are interposed between the wheels, floats, skis or tail skids and the main structure of the plane.

SHOCK AND COLLAPSE. In all severe injuries, whether from blows, burns, wounds or other causes, there arise symptoms due to the condition

known as surgical shock or collapse. It is also called traumatic shock. These symptoms seem to be the result of violent sensory impulses upon the nervous system. Consequently, the control of the arteries normally exercised by the central nervous system is lost, and the arteries and capillaries relax.

In the most severe injuries there may be instantaneous death which is probably the result of extreme shock. In less severe cases, there are pallor, weakness and faintness. The hands, feet and general body surface may feel cold to the touch. The pulse is rapid and the heart beat is weak. The blood pressure is low.

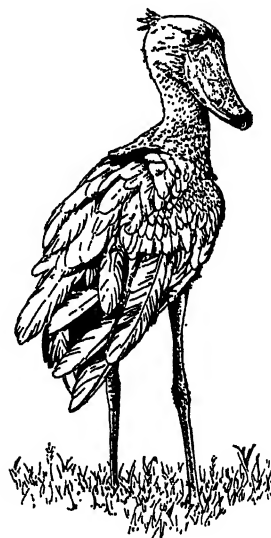
In other serious cases, surgical shock may prove fatal within a few hours following the injury. In less serious cases, the symptoms disappear slowly or quite rapidly. The degree of shock is not always proportionate to the amount of injury or the severity of the pain. Some trivial injury, such as the sprain of a finger, occasionally may be attended by well-defined symptoms of shock. The exact mechanism of the production of shock is not definitely determined. Phlegmatic persons seem less prone to suffer from shock than do nervous types.

The emergency treatment of shock and collapse consists of first placing the patient flat on the back with the head low. Secondly, heat should be applied externally with hot blankets, and hot water bottles. The person should be put in a warm room, if possible. Hot, sweetened drinks, preferably hot coffee or tea, should be given. Pain should be relieved in any way possible.

The physician's treatment will include measures to favor all of these objects; that is, attempts to stimulate the circulation, and produce body warmth. Stimulants, such as caffeine, are utilized in this condition. Alcohol in large amount is considered inadvisable, but may be given in teaspoonful doses. Aromatic spirits of ammonia in small doses in water is also helpful.

Hypodermic injections of salt solution are given at a temperature of 105° F. or at least above normal body temperature. If the condition is critical, the salt solution should be injected into a vein. If there has been no hemorrhage, the salt solution is not as efficacious as in those instances where hemorrhage has occurred.

SHOE-BILL (*Baleniceps rex*), called also whale-head, a very large bird of the booby family remarkable for its enormous hook-tipped bill, 8 in. or more



SHOE-BILL

W. I. F.

in length. It is a native of central Africa, frequenting bushy swamps near the White Nile and its tributaries. This unusual bird, which stands about 4 ft. high, has a short neck, a short bushy crest, long, broad wings and very long legs. Its plumage is dark gray above, deepening into blackish on the wings and tail, and pale gray below. In habit the shoe-bill is gregarious, usually appearing in small companies. Its food consists of fish, water snakes and sometimes carrion. The shoe-bill breeds during the rainy season scraping a hole in the ground near the water's edge for a nest and laying 2 to 12 small, bluish-white eggs.

SHOFAR, a curved blowing instrument fashioned from the horn of the ram and blown in synagogues on the Jewish New Year's Day (Rosh Hashanah) and on the Day of Atonement (Yom Kippur). The shofar corresponded to the clarion or to the Roman tuba, not to the trumpet or cornet. In ancient Israel the shofar, or ram's horn, was employed chiefly as a signal in military operations, as a signal for the attack, for the mustering of the army, for the dismissal of the army, or for the march of the army homeward. It was used also to announce an imminent danger or a great public occurrence, such as the coronation of a king. In later Biblical times it was blown on the first day of Tishri, the seventh Hebrew month of the year, also at the ushering in of the Jubilee year, the 50th year of the ancient Hebrew cycle. The shofar and other musical instruments were later employed in the divine service conducted in the Temple at Jerusalem.

From the fact that the shofar was blown in ancient times on the first day of Tishri in order to usher in the New Year, it soon came to acquire a solemn and enduring religious significance. The blasts of the shofar on this sacred day were felt to be a divine summons to repentance and moral improvement, which significance the day later came to possess. Furthermore, the blowing of the shofar was associated with the recollection of the revelation of God's Law on Mt. Sinai, an occasion on which the shofar had been blown, and with Abraham's intended sacrificing of his son Isaac on Mt. Moriah, and the substitution of the ram for the human sacrifice after Abraham's loyalty to God had been tested and not found wanting.

On the Day of Atonement the shofar is blown to mark the conclusion of the holiest day of the Jewish calendar. It is of interest to note that the Jewish prohibition of labor on the Sabbath Day is so stringent that the blowing of the shofar in the synagogue is regularly omitted whenever either New Year's Day or the Day of Atonement falls on the Sabbath.

A. SH.

See Cyrus Adler, *The Shofar*, 1894.

SHOLAPUR, a city of the Bombay Presidency, India, 160 mi. southeast of Poona. Its situation between Poona and Hyderabad has made it, especially since the opening of the Great Indian Peninsula Railway, the center for the trade of a large extent of country. The chief industry is the manufacture of

silk and cotton cloth. Sholapur was stormed by the British in 1818 when the district was incorporated in the Bombay Presidency. Pop. 1921, 119,581; 1931, 135,632.

SHOLEM ALEICHEM (1859-1916), pseudonym of Sholem Rabinowitch, Jewish humorous writer, who was born in Pereyaslev, Russia, Feb. 18, 1859. As a small child he showed an astonishing power of humorous mimicry. At 17 he became a teacher in a village school, and then tutor to the daughter of a wealthy family. Obligated to leave owing to the affection that developed between his pupil and himself, he went to Kiev, later being appointed administrative rabbi of Lubni, an appointment he held until 1883. He then returned to Kiev and began contributing humorous poems, sketches and tales, mainly of Jewish life, to the local press, adopting the nom-de-plume of Sholem Aleichem. His success was followed by his marriage to his former pupil. Established as the leading literary figure in Kiev, in 1905 he visited New York City, but returned to Europe in 1907 and lectured in many of the chief European cities. During the World War he again visited New York. *Tevieh the Dairyman* is generally regarded as Sholem Aleichem's masterpiece. The writer died in New York, May 13, 1916.

See Graetz, *History of the Jews*.

SHOLEM RABINOWITCH. See **SHOLEM ALEICHEM**.

SHOOTING, the discharge of a missile from a gun, bow or other weapon. For the purposes of this article, the subject is limited to shooting with firearms. Shooting is one of the chief activities in the training of soldiers and sailors, as well as members of police, national guard and similar organizations. In general, this training may be divided into shooting with revolvers or pistols, rifles and machine guns. Shooting galleries are provided for training in the headquarters of most city police forces and in the armories of the various national guard units. Both indoor and outdoor ranges are used by sailors, marines and soldiers of the national forces. There are also many rifle clubs in the United States, members of which compete with chosen representatives of military and naval organizations at the annual championships. Many military schools and colleges send representatives to these meets, where prizes are awarded to individuals and to teams. Shooting competitions in these championships include such distances as 100 yards standing, 200 yards kneeling, and from 500 to 1,000 yards lying down.

HUNTING, of course, includes shooting, and it is estimated that 3,000,000 hunters go after game each year during the hunting seasons in the various states. Rifles are used for bear, deer and similar big game, while shotguns are used by game bird hunters. TRAP SHOOTING at clay targets thrown from traps so that they imitate the flight of birds is a very popular sport, and district, sectional and national championship trap-shooting events are held annually. See **BIG GAME HUNTING**; **BIRD SHOOTING**.

SHOOTING-STAR, a genus (*Dodecatheon*) of attractive perennials of the primrose family, sometimes called also American cowslip. There are about 30 species, all American, found chiefly in the Rocky Mountain region and on the Pacific coast. They are mostly low herbs with basal leaves and naked flower-stalks bearing nodding, cyclamen-like flowers in terminal umbels. Of several species more or less grown in gardens the best known is the common shooting-star (*D. Meadia*), native to moist prairies from Pennsylvania to Manitoba and southward to Georgia and Texas. Representative western species are the alpine shooting-star (*D. alpinum*), of the Sierra Nevada and the lowland shooting-star (*D. patulum*) of California valleys.



CALIF.. COPYRIGHT
LOWLAND SHOOTING-STAR

SHOOTING STARS, the popular and incorrect name given to METEORS.

SHORE PROTECTION, the proper protection of coasts, banks, etc., against EROSION. It must be based on an analysis of conditions and of the causes of erosion in each case. The works commonly used in protection of coasts are BREAKWATERS, SEA WALLS, REVETMENTS, and GROINS. The effect of such works is to minimize the destructive effect of currents and wave action.

In rivers and inlets the protection is by JETTIES, DIKES or training walls, and REVETMENTS. The purposes of jetties and dikes are to control the flow so as to keep destructive currents from the banks. Revetments serve as direct protection of banks or shores from current or wave action. See also RIVER IMPROVEMENT.

BIBLIOGRAPHY.—E. R. Matthews, *Coast Erosion and Protection*, 1913.

SHORTENING, fat used to enrich bread, crackers, cakes, cookies and pastry, to make the finished product more tender and easier to break, and to increase its flavor, nutritive value and keeping qualities.

Various fats are employed for this purpose, including BUTTER, LARD, margarine, hydrogenated vegetable oil, cream, and oils. Each has its advantages and disadvantages. Butter and cream give an attractive flavor and a delicate texture when used in cakes, but tend to result in a crumbly rather than a flaky pastry. The same may be said of poultry fat and margarine. Cakes made with lard do not have as good a flavor or as delicate a texture as those made with butter, but lard makes a flaky pastry. Oils are sometimes used for cake-making but are generally

considered less desirable than solid fats for this purpose. They produce a tender pastry.

Shortening acts by interposing itself in layers between the particles of dough, preventing the formation of one continuous mass when baked. It does not dissolve. During mixing, it coats the surface of each particle of dough with a greasy film, so that the gluten fibers do not cohere so firmly as they otherwise would. During baking it forms many minute fat-filled cracks. The shortening power of different fats depends, to a great extent, upon their plasticity at the temperature of mixing. They must spread thoroughly but not run out. Fats of high melting point (hard fats) are not plastic enough to spread through the dough, and therefore do not make good shortening.

H. T. B.

BIBLIOGRAPHY.—Platt and Fleming, *Action of Shortening in the Light of the Newer Theories of Surface Phenomena*, Journal of Industrial and Engineering Chemistry, vol. 15, page 390, 1923.

SHORTER, CLEMENT KING (1857-1926), English journalist, was born in London, July 19, 1857. He edited the *Illustrated London News* in 1891-1900, and founded and edited *Sketch* in 1893, the *Sphere* in 1900 and the *Tattler* in 1903. He wrote much criticism and literary history, including *Charlotte Brontë and Her Circle*, 1896, and several other works on the Brontës. Shorter also edited Boswell's *Life of Dr. Johnson*, 1922, and Mrs. Gaskell's *My Diary*. He died Nov. 19, 1926.

SHORT GRASS COUNTRY, the high areas of the Great Plains of western United States, covered with a short grass sod and used chiefly as cattle ranges. These regions are most extensive in Montana, Wyoming and Texas. The native vegetation, including bunch grass, buffalo grass and sagebrush, is remarkably hardy and nutritious, providing winter as well as summer feed. This region was originally the range of great herds of buffalo and the home of numerous tribes of Indians. For many years the American settlers considered it wasteland because it was semi-arid and not suitable for cultivation. After the Civil War its value as grazing land was discovered. During the next 30 years it was the scene of the development of an enormous cattle industry which gave origin to great fortunes and to dramatic feuds between cattle and sheep men. With the coming of permanent settlers the open range was divided into homesteads.

SHORTHAND, a system of writing which uses very simple marks or symbols instead of letters to make it possible to take down words as fast as they are spoken, straight lines, simple curves, dots, dashes, etc., being thus employed. Earlier systems of shorthand, which was known even in Rome, were orthographic, i.e., symbols were substituted for letters and not for sounds. Modern shorthand, however, is phonographic, using symbols instead of letters for sounds or groups of sounds.

BIBLIOGRAPHY.—T. Anderson, *History of Shorthand*, 1882; I. Pitman, *A History of Shorthand*, 1891.

SHORTIA, a genus of evergreen herbs of the diapiensia family comprising two species, one (*S. uniflora*) native to Japan and the other (*S. galacifolia*), a rare plant native to North Carolina, known as little colt's-foot or OCONEE BELLS.

SHORT SELLING, the sale of a security, usually Stocks, for future delivery. Commodities sold for future delivery may also be said to be sold short. In stocks the short seller disposes of shares which he does not own or possess with the object of obtaining the stock at a lower price than that for which he sells it, believing that the market will decline. He is a Bear. The seller tells his broker to sell short say 100 shares of U. S. Steel Corporation at 144. If the market declines on the same day to five points below the selling figure the broker buys at the lower figure, delivers the stock to the purchaser and his customer has made a profit of five points on the transaction. But if no decline takes place on the day of the transaction the broker must deliver the stock he has purchased before 2.15 P.M. of the next day. He borrows this stock, in return loaning its owners the market value of the stock at the close of the market on that day. The short seller must pay all dividends on the stock of which he is short. See MARGIN TRADING.

SHORT STORY, a fiction form differing from the NOVEL and the novelette not merely by reason of its relative brevity, but also owing to the definite effect of unity and totality that it produces. The form has no doubt existed since the earliest times, but it was not a conscious or deliberate production until the 19th century, when EDGAR ALLAN POE laid down definite rules to govern its composition. The short story, he asserted, should give an impression of singleness of effect, and for this reason it should be capable of being read at one sitting.

In America the usual length of the short story is between 3,000 and 6,000 words, but provided that unity of effect is maintained, there is nothing to prevent its reaching 40,000 words, as did Henry James's *Turn of the Screw*, or to bar stories as short as 1,000 words.

The short story has flourished in the United States to a degree unknown elsewhere. It was the publication of Washington Irving's *Sketch Book* that gave greater popularity to the form among Americans. Since then almost all the writers eminent in American literature have lent their distinction to the short story or have attained fame by their work in this field. Hawthorne, Poe, Bret Harte, Mark Twain, Frank R. Stockton, Mary E. Wilkins Freeman, O. Henry, Jack London, Edith Wharton, Henry James, Sherwood Anderson, Willa Cather, Irvin S. Cobb, Joseph Hergesheimer, Edna Ferber, Fannie Hurst and Booth Tarkington have all written distinguished short stories. Of the many authors who have successfully used this medium abroad, the outstanding include de Maupassant, Chékov and Rudyard Kipling.

BIBLIOGRAPHY.—H. S. Canby, *Study of the Short Story*, 1913; F. L. Pattee, *Development of the American Short Story*, 1923; Frances Newman, *The Short Story's Mutations*, 1924.

SHORT-WAVE ADAPTERS, CONVERTERS, the devices whereby RADIO RECEIVERS built for use on BROADCASTING channels may be used for the reception of short-wave signals (see ELECTROMAGNETIC WAVES). The adapter ordinarily consists of a short-wave DETECTOR with or without a preceding stage of radio-frequency amplification. The device is plugged into the detector tube socket of the broadcast receiver, and only the AUDIO-FREQUENCY amplifier, the LOUD SPEAKER and the POWER PACK of the receiver are used.

The short-wave converter is a type of FREQUENCY CHANGER which converts the short-wave signals received by the ANTENNA to signals having wave-lengths within the broadcast channel. It utilizes the RADIO-FREQUENCY-amplification circuit of the broadcast receiver as well as the elements used by the short-wave adapter. L. G. H.

SHORT-WAVE RECEIVER, a RADIO RECEIVER especially designed for the reception of radio signals (see ELECTROMAGNETIC WAVES) of short WAVE-LENGTH, or high frequency. Largely because of the importance of electrical capacities (see CAPACITANCE) of all parts of a radio receiver, it is not possible to build a RADIO-FREQUENCY amplifier which will function as efficiently at the higher frequencies as at those in the BROADCASTING band. Usually, only a single stage of tuned radio-frequency amplification is used ahead of a DETECTOR; often this is omitted. The detector is usually regenerative (see REGENERATION), and both three-element and SCREEN-GRID TUBES (see TUBES, ELECTRONIC) are in common use. SUPER-HETERODYNES have been used to some extent. The AUDIO-FREQUENCY part of the receiver may be the same as in the ordinary radio receiver. L. G. H.

SHOSHONEAN, one of the most important American Indian linguistic families formerly holding an area exceeded in extent only by the Algonkian and Athapascan families. Their territory comprised the great interior basin between the central Rocky Mountains and the Sierras, extending on the north into southwestern Montana, southern Idaho and southeastern Oregon, southeast into the Texas prairies and southwest across southern California to the Pacific. The chief Shoshonean tribes are the Bannock, Comanche, Mono, Hopi, Kawia, Mission Indians, Paiute, Paviotso, Chemehuevi, Ute, Pahvant, Panamint, Serrano and Shoshoni. The various tribes varied greatly in culture traits, the extremes being represented by the Hopi and the so-called Digger Indians of California. The Hopi of northeastern Arizona have become true village Indians. They are a part of Pueblo culture and have little more than linguistic affiliation in common with the rest of the Shoshonean stock. They are agriculturists and skillful weavers and makers of pottery. In the eastern, northern and northwestern sections of the territory were the Plateau Indians represented by the Comanche, Ute, Bannock and Shoshoni tribes. They were in general a fierce, warlike people, practicing no agriculture and deriving their main livelihood from hunting. Many of the Sho-

shoneans west of the Rocky Mountains occupied country which was barren and contained no big game. They were forced to live in an extremely rude and simple manner and subsisted chiefly on rabbits, small game, fish, roots and seeds. Their standard of living, however, was not as low as the epithet Digger Indians, frequently applied to certain Shoshoneans, would indicate. Certain authorities maintain that the Shoshoneans are part of a larger linguistic family which they have designated Uto-Aztecan.

SHOSHONE CAVERN, a national monument situated 4 mi. south of Cody in northwestern Wyoming, has an area of 210 acres and was established Sept. 21, 1909. The cave is near the summit of Cedar Mountain and its main cavern leads back approximately 2,500 ft. into the mountain. The entrance, an opening 20 ft. wide by 6 ft. high, overlooks the Shoshone River and the Cody entrance road to YELLOWSTONE NATIONAL PARK which passes within about 1 mi. of the cave.

SHOSHONE DAM, located on the Shoshone River near Cody, Wyo., is noted as one of the earliest high, concrete arch dams, as well as for the fact that its height is nearly twice as great as its top length. The greatest height of this rubble concrete structure above foundation level is 328 feet and above stream bed, 243 feet. Its greatest thickness is 108 feet and its volume is 75,000 cubic yards. It is a non-overflow dam, the spillway being a tunnel 20 feet square through the rock walls of the canyon. The reservoir of 20 billion cubic feet which this dam creates, stores water for IRRIGATION uses.

SHOSHONE FALLS, a great cataract on the Snake River in Idaho. The falls occur in Jerome Co. where the river runs through a canyon 800 ft. deep and about 1,000 ft. wide formed by ridges of hard rock uncovered by the wearing away of superimposed lava beds. The water cascades for 30 ft. through a rocky channel and then plunges down for 190 ft. into a lake at the bottom of the gorge. After Niagara and Yosemite, this fall is the most imposing in the United States. Its descent is 43 ft. greater than that of Niagara but the width and volume are considerably less.

SHOSHONI, a North American Indian tribe speaking a dialect of the Shoshonean linguistic stock. They originally occupied western Wyoming and Montana, central southern Idaho, northern Utah and Nevada and eastern Oregon. Their typically plateau culture has been modified by contact with the Plains tribes. At certain times they hunted buffalo though their food consisted primarily of small game and fish. Their principal ceremonials are the Sun Dance, the Wolf Dance and the Bear Dance. Surviving Shoshoni live on the Wind Reservation in Wyoming and the Fort Hall Reservation in Idaho.

SHOT FIRING, in mine BLASTING, the setting off of high explosive charges used to break rock or ore.

SHOT PUTTING, a standard weight-throwing event in track and field meets, including the OLYMPIC GAMES. The shot used in championship competitions

is a ball of lead weighing exactly 16 pounds. In indoor meets a perfectly round leather bag of lead shot is used. Junior athletes use a 12-pound shot. The shot is put from a seven-foot circle with a raised edge to prevent over-stepping, which constitutes a foul. The weight must be put, or pushed straight from the shoulder, and may not be thrown or bowled. Usually each contestant has three tries, and his best distance is counted. Standing at the back of the circle, his left side facing the direction in which the put will travel, the athlete holds the shot close to his right shoulder and rests his weight on his right foot, balancing himself with his left arm extended. He hops forward on his right foot, then puts the shot forward, swinging half around to the left as he releases it. The momentum of the hop and the body swing combines with the chest, shoulder and arm muscles to propel the weight. For years during the last century, a put of 47 feet was considered remarkable; but the record in 1932 stood at 52 ft. 8 $\frac{3}{8}$ in.

SHOTWELL, JAMES THOMSON (1874-), American historian, was born at Strathroy, Ontario, Canada. He graduated from Toronto University, 1898 with the degree of B.A., and received the degree of Ph.D. from Columbia University in 1903. He was appointed Lecturer on History at Columbia in 1900, instructor 1902-05, adjunct professor 1904-07 and professor of history 1907 which he still is. He was Assistant General Editor for the *Encyclopaedia Britannica* in London, 1904-05. He was Chairman of the National Board for Historical Service at Washington, D.C., in 1917 and at the Paris Peace Conference, 1918-19, he was chief of the Division of History and a member of the International Labor Legislation Commission. Professor Shotwell was in 1919 American member of the committee which organized the International Labor Conference. Since 1924, he has been a trustee of the Carnegie Endowment for International Peace, and also Director of the Division for Economics and History. He was from 1915 to 1921 editor of the *Records of Civilization, Sources and Studies*, and since 1919 until the present he has been the editor of the *Economic and Social History of the War*, published by the Carnegie Endowment. Among his numerous writings are *The Religious Revolution of To-day*, 1913; *Labor Provisions in the Peace Treaty*, 1919; *An Introduction to the History of History*, 1921; and *War as an Instrument of National Policy*, 1929.

SHOULDER, the prominence formed by contiguous portions of the collar-bone, shoulder-blade, and arm-bone, together with certain muscles acting on these bones. The shoulder-joint is that between the glenoid cavity of the shoulder-blade and the head of the humerus. The former is a shallow depression, while the latter is a rounded eminence somewhat less than a hemisphere. It is obvious, therefore, that the chief strength of the joint lies in its ligaments and the muscles which surround it. The chief ligament is an annular closed capsule passing between the two bones participating in the articulation.

There is a wide range of movement in the shoulder-joint in all axes. However, if the arm is elevated at the side beyond a right angle, the joint becomes fixed and the shoulder-blade moves with the arm.

Owing to its loose attachment, the shoulder is frequently dislocated, the most usual direction being downward and forward. See SKELETON; JOINTS AND LIGAMENTS.

SHOVELER, the common name for a genus (*Spatula*) of fresh-water ducks, remarkable for their long bill which is greatly broadened at the tip into a shovel-like expansion. There are four species of wide distribution. The common shoveler (*S. clypeata*), found almost throughout the northern hemisphere, breeds in North America from Texas to Alaska and winters southward to the West Indies, Colombia and Hawaii. It is about 20 in. long, the male having a dark green head and neck, brown back, white breast, chestnut underparts, and a bright green wing patch. The female is more predominantly grayish-brown in color. This species feeds chiefly in shallow waters straining in the mud with its large bill for all sorts of animal and vegetable food. It nests in thick grass, often at a distance from water, laying 6 to 11 pale buffy or bluish-white eggs.

SHRAPNEL, a projectile consisting of a steel case, a small chamber in its base filled with powder, a diaphragm upon which rests a mass of lead balls fixed in a matrix, a time fuse and a tube connecting the fuse with the powder charge. Upon ignition by the fuse, the powder charge throws out the lead balls, adding velocity to that already in the projectile.

SHREDDERS, machines used in harvesting corn. The ears are first snapped from the stalk as it is passed between a pair of rolls. Other rolls remove the husks and a conveyor places the ears in a wagon. The snapping rolls feed the stalks or stover to a revolving shredder head made up of spiral knives for shredding. The stover and husks then pass over a vibrating shoe which removes the shelled corn before entering a blower to be conveyed to the pile.

BIBLIOGRAPHY.—A. A. Stone, *Farm Machinery*.

SHREVEPORT, a city of northwestern Louisiana, the seat of Caddo Parish, is situated on the Red River, about 300 mi. northwest of New Orleans. Transportation facilities include the Texas and Pacific, Kansas City Southern, St. Louis Southwestern, Illinois Central, Southern Pacific and Louisiana and Arkansas railroads and the Louisiana Railway and Navigation Co. of Texas, bus lines and several airports. The city is the distributing point for a rich cotton-growing region. Near by are important oil and gas fields. Among the manufactures are cottonseed products, lumber and machinery. In 1929 the industrial output reached approximately \$21,000,000; the retail business amounted to \$40,998,061. Shreveport was settled about 1836 and named for Capt. Henry Miller Shreve. In 1839 the town was incorporated and in 1871 received a city charter. Pop. 1920, 43,874; 1930, 76,655.

SHREW, a small insectivorous mammal of the family *Soricidae*. Shrews abound throughout a large portion of North America, extreme northern South America, Europe, Asia and Africa. They are highly variable, and much divided in classification. In the United States there are many species, one of which, $3\frac{1}{2}$ in. in length, is the smallest four-footed animal known. Shrews have a mouselike appearance, but with a long pointed muzzle, and the mouth is filled with sharply pointed teeth. Although numerous, and rapid breeders, they are rarely



COMMON SHREW



COURTESY AMER. MUS. OF NATL. HISTORY

ELEPHANT SHREW

seen, owing to their small size, largely nocturnal habits and undercover life. Those who wish to study them must use traps. These should be set in brushy places,



TREE SHREW
(*Lepoia chrysura*)

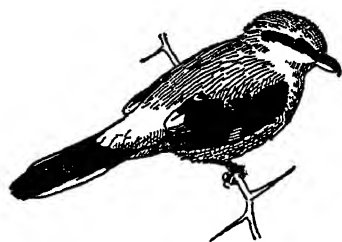
near decayed stumps or logs, beneath or within which these little creatures make their nests, and from which they get many beetles, worms and grubs. They creep about beneath dead leaves or other cover, yet become the prey of owls and other birds and animals of various sorts, although comparatively few of their enemies will eat them, except during extreme hunger. E. I.

SHREWSBURY, the county town of Shropshire, England, lying mainly upon a peninsula formed by the Severn, 163 mi. northwest of London. Situated as it is upon the border and main routes of Wales, Shrewsbury was early the target for Welsh raids, and later, during the medieval and Elizabethan periods, profited from Welsh trade. The remnants of the Norman castle are reminiscent of the troubled border days. The Abbey, founded by Roger de Montgomery, shows slight survival in the massive nave of the restored Abbey Church. The town itself, with

its crooked, hilly streets quaintly named, retains many ancient houses and churches, among them the cruciform St. Mary's founded in the 10th century and boasting a fine Jesse window. The 16th century grammar school, now removed, was once attended by Sir Philip Sidney and Charles Darwin, a native of Shrewsbury. There has been a locomotive works here since 1918, and other industries are springing up in the adjacent flatlands. Pop. 1921, 31,006; 1931, 32,379.

SHREWSBURY SCHOOL, a noted boys' school, at Shrewsbury, Shropshire, England. It was founded by Edward VI in 1552, but was not opened till 1562. Under the headmastership of Bishop Samuel Butler, between 1798 and 1839, Shrewsbury gained a wide reputation as a classical school. It moved in 1882 across the river Severn to the present site, where it occupies handsome buildings designed by Sir Arthur Blomfield. The average number of students is 500. Among distinguished students of the school have been Sir Philip Sidney and Charles Darwin. The faculty in 1928 was headed by Rev. H. A. P. Sawyer.

SHRIKE, the common name for a numerous family (*Laniidae*) of passerine birds native chiefly to the Old World. Typically, they are of robust build and rapacious habits, with strong, hooked bills and powerful wings. Of some 200 known species only two occur in the United States and Canada. The northern shrike or butcher bird (*Lanius borealis*), about 10 in. long, with soft gray, black and white plumage, breeds in the far North and winters in the northern United States. It feeds largely upon injurious insects and mice and in winter on English sparrows, often impaling its prey on sharp branches or thorns to be devoured at some later time. The butcher bird nests in low trees or bushes, laying dull whitish, spotted eggs. Although its ordinary



G. M. SUTTON. "BIRDS OF PENNSYLVANIA"
J. HORACE McFARLAND CO. COPYRIGHT

NORTHERN SHRIKE

note is discordant, it has an excellent song. The slightly smaller loggerhead shrike (*L. ludovicianus*) of the eastern and southern United States, with ashy blue and white plumage, is similar in its habits and is very useful about farms by destroying mice and insects though it does kill a few smaller birds. Five varieties occur in the northern and western states.

SHRIMP, the name commonly given to smaller members of a crustacean suborder (*Natantia*) and especially to the family *Crangonidae*. The most

familiar are the common shrimp (*Crangon vulgaris*) of the North Atlantic, and the abundant species (*Crangon franciscorum*) of the California coast. As the shrimps are swimmers rather than bottom dwellers the paddle-like limbs of their abdomens and tails are relatively larger, and their pincer claws relatively smaller than in their near relations, the lobsters and crayfish, which they otherwise resemble. Big shrimp-like crustaceans are called prawns.

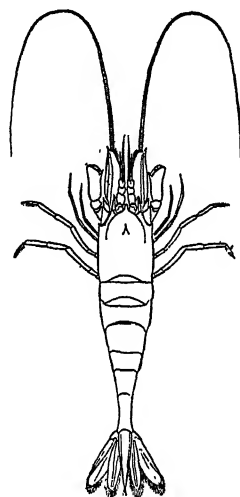
Shrimps frequent shallow sandy places and are often found in the larger tide pools when the tide goes out. Their humped bodies are almost transparent, so that until they move they are hard to see against a background either of sand or rock. Then they dart about so rapidly that they become visible at once. If they are frightened they bury themselves in the sand, digging with their tails. Almost any animal food is welcome to them, fish eggs particularly. There are important shrimp fisheries in Europe, Japan and America. The animals are caught with nets when they come near the beaches at high tide. They are excellent for food, and may be either canned or shipped fresh to market.

In 1929 the total commercial catch of shrimp in United States waters, taken chiefly on the south Atlantic and Gulf coasts, amounted to 113,263,000 lbs. with a value of \$4,575,000.

A. I. W.

SHRINE (from Latin *scrinium*), originally a drawer or wooden box, later a cabinet or wardrobe. The characteristic feature of the shrine was that it could be closed, for which reason the medieval carved altar pieces, or triptychs, whose two wings could be used as doors to protect the central piece, were called altar shrines. The coffins of saints and receptacles containing their relics are called shrines. They are numerous in Catholic countries and some constitute important works of art, such as the golden shrines at Cologne, Siegburg and Aachen (Aix-la-Chapelle). See also SACRARIUM.

SHROVE TUESDAY, the day before Ash Wednesday. It received its name from the shriving given the people of England who on this day confessed their sins to the priests in preparation for Lent. On the European continent the folk whose sins have been forgiven have from the earliest times made it a day of *carne-vale*, farewell to flesh meat. The bell that called men at noon to come and confess now signals them to cease work. In France the celebration is called *Boeuf gras*, and at Nice King Carnival begins his brief reign. A similar carnival is held at



COMMON SHRIMP

Venice and elsewhere, while Rome celebrates with a battle of flowers. In the United States, New Orleans holds *Mardi gras*.

SHRUB, a woody plant, usually smaller than a tree, and having usually more than one central axis or stem arising from the ground. There is no constant or invariable difference between shrubs and trees. Many shrubs have a single stem and are much taller than some trees, and not a few trees have more than one trunk, especially after an injury.

Because of their low stature many shrubs are plants of the under canopy of the forest, but in extensive scrub, moor or desert regions where trees are largely absent shrubs dominate the vegetation. See **TREE**.

SHRUBBY ALTHEA, a name commonly used by gardeners for the *ROSE OF SHARON*, a handsome ornamental shrub of the mallow family.

SHRUB YELLOWROOT (*Zanthorhiza apifolia*), a small smooth shrub of the crowfoot family, native to woods in the southeastern United States and sparingly grown for ornament. The bushy stems, 1 to 2 ft. high, bear much divided, celery-like leaves, small brownish-purple flowers in narrow drooping clusters and yellowish pods (follicles) each containing a single seed. The long bitter yellow roots are sparingly used in medicine for their tonic properties.

SHTIP or **ISHTIP**, a town of Macedonia, YUGOSLAVIA, situated on the Otinia River in a rich grain district. Until recently the capital of the Bregalnishka Djupania, Shtip is now included in the Vardar Banovine, of which Skoplye is the capital. The town is the market center for the region, which grows wheat, maize, poppies and tobacco. In 1913 Shtip was occupied by the Serbian army and given to Serbia by the treaties of London and Bucharest. Near by is the village of Novo-Selo, the birthplace of the great Macedonian revolutionary patriot, Todor Alexandroff. In Novo-Selo was born also Ivan Michailoff, chief-tain of the Macedonian revolutionaries. Pop. 1931, 12,080.

SHUMEN, sometimes erroneously *Shumla*, a city in Bulgaria, situated in the hills about 50 mi. from Varna. It is on the route between Dobrudja and Thrace and an important stop on the trunk line between Sofia and Varna. Like most Bulgarian towns it is distinctly Turkish in appearance with wooden houses climbing in terraces up the hills and many mosques lifting their minarets above them. It is the capital of the department of Shumen and the trading center of the region, which is rich in grain and livestock. Besides a modern brewery, the city has tanneries, metal works and textile industries. Shumen in Turkish days was a garrison town and an important military stronghold because of its natural fortifications. It was repeatedly besieged by the Russians and as late as 1877-78 successfully defended. The city has been used by both the Turks and the Bulgarians as an exile town. Pop. 1931, 26,000.

SHUSWAP, an important tribe of the North American Indian SALISHAN linguistic stock living in British Columbia. They formerly occupied most of

the territory between the Columbia and the Fraser rivers, including the Thompson River valley above Ashcroft. They are now limited to a number of small village reservations attached to the Kamloops-Okanagan and Williams Lake agencies.

SHYLOCK, the chief character in Shakespeare's *MERCHANT OF VENICE*. A Jewish money lender, Shylock welcomes the opportunity to loan 3,000 ducats to Antonio, a merchant who has roused the Jews' hatred by sneering at his race. If Antonio cannot repay the loan at the stipulated hour, it is agreed that he forfeit to the Jew one pound of his own flesh. Antonio's cargoes are delayed. As Shylock prepares to collect his due, Portia appears disguised as a barrister, and thwarts the Jew by declaring that he must take no drop of Antonio's blood with his pound of flesh.

SIA, a pueblo and North American Indian tribe speaking a dialect of the Keresan linguistic stock. Sia is situated on the north bank of the Jemez River 16 miles northwest of Bernalillo, N.M. The Sia joined the other pueblos in the revolt of 1680, but after the demolition of the pueblo and the loss of many of its inhabitants, became friendly toward the Spaniards, consequently inciting the enmity of the Jemez and Cochiti. The present population, numbering less than 200 in 1931, like most of the other pueblos, still maintains much of the ancient communal life.

SIAM, a kingdom of southeastern Asia, bounded on the north and east by French Indo-China, on the west and north by Burma and on the south by the Gulf of Siam and the British Malay states. Area 200,148 sq. mi. Pop. 1929-30, 11,506,207.

Siam is divided into five main divisions: northern, central, northeastern, southeastern and southern. It consists largely of the basin of the Me Nam and the upper basin of the Me Yom. The Me Nam lies in the parallel ranges of the northern country and flows through a broad alluvial plain in which are situated most of the towns and villages. The high mountains which form a western watershed of the basin are heavily forested. Eastern Siam, a plain of the upper Me Yom, is very largely savanna country.

The forests of the north and northwest contain splendid teak, which is felled, hauled down by elephants to the rivers and floated to BANGKOK, the capital, where elephants are chiefly used in moving the heavy logs. Rice is the important crop, others being pepper, tobacco, and betel nuts. Rubber is found in the extreme south. Fishing is important. In fact, rice and fish are generally the fare for every meal. The Buddhist religion of the vast majority of the Siamese deprecates the taking of animal life.

Nearly all the railroads are state-owned. In recent years there has been extensive building. Since 1922 through express trains run between Bangkok, Penang and SINGAPORE, as well as between Bangkok and Chiang-mai.

The chief mineral is tin, mined at Puket Island and at Penang on the mainland. Gold is found at Tomoh, Bangtophan, Wattan and Krabim in the upper Me Yom basin, which is connected by rail

with Bangkok via Ayuthia. Other minerals are wolfram, iron, zinc and antimony. Some coal is worked.

The climate and seasons closely resemble those of India; the so-called cold season lasts from the end of November to February, the hot season from March to April and the rains from May to Oct. Central Siam benefits from the cooling winds of the Gulf of Siam from March to October; the basin of the eastern division is cut off from these and suffers greater extremes as well as a lower rainfall. The south has a short dry season and a small annual range. H. A. A.

History. Cambodian domination of the Me Nam valley was overthrown in 1351, and Siamese history really begins from that date. The rulers engaged in a series of wars with neighboring countries, and the territorial area varied considerably from time to time. For some centuries Siam paid tribute to China, but the Chinese suzerainty was nominal only. In the 18th and 19th centuries, western traders and adventurers knocked at Siam's doors, but the country succeeded in maintaining its independence while its neighbors fell under the control of various western nations. Siam, however, was compelled to submit to the establishment of foreign extraterritorial rights in the country. The Siamese rulers in the latter part of the 19th century embarked on a program of modernizing their country. Members of the ruling family were sent to western countries to study, roads and railways were built, education was improved, western advisers were employed to assist in the reconstruction of the courts, etc. After prolonged efforts on the part of the Siamese to end the extraterritorial system, Britain agreed to the change in 1926 and the other powers followed suit. Following a rebellion of the army and navy in 1932, Siam became a constitutional monarchy.

There has been a steady movement of Chinese settlers into Siam, particularly since the beginning of the 20th century. In recent years the number of migrants has amounted to between 200,000 and 250,000 annually. G. C.

SIAMESE, a language spoken by about 6,000,000 people in the kingdom of Siam, and a member of the Sino-Thai (or Siamo-Chinese) branch of the SINO-TIBETAN linguistic family. Like CHINESE, it is monosyllabic and "isolating," and possesses a system of tones for each word, but its phonology is rather different. It agrees with all the other Thai languages in having various points of resemblance with the MON-KHMER linguistic family, and so may possibly form part of an AUSTRO-ASIATIC family, although the actual existence of the latter has not yet been proved. The alphabet is borrowed from India. J. J. L. D.

See W. Trittel, *Einführung in das Siamesische*, 1930.

SIAN, provincial capital of Shensi, in northwest China, situated on the Wei River, in a wheat-raising region. The city is famed, under the ancient name of Chang-an, as having been the capital of the Chinese Empire for 2,000 years. Sian and its surroundings are rich in antiquities. In 1625 a large stone tablet of the 8th century was discovered; the inscription has more than 2,000 characters in Chinese and Syriac,

and tells of the arrival in 635 of Nestorian missionaries. Pop. est. 1,000,000.

SAULIAI (SHAVLI), a city of Lithuania, situated about 80 mi. north of Kaunas (Kovno), with which it is connected by rail. It is a center of a lumber industry and the agricultural market for the region. Pop. 1931, 22,996.

SIB, a blood-relation or kinsman. The use of the term is restricted by some anthropologists to relationship through the mother. See GENS; CLAN.

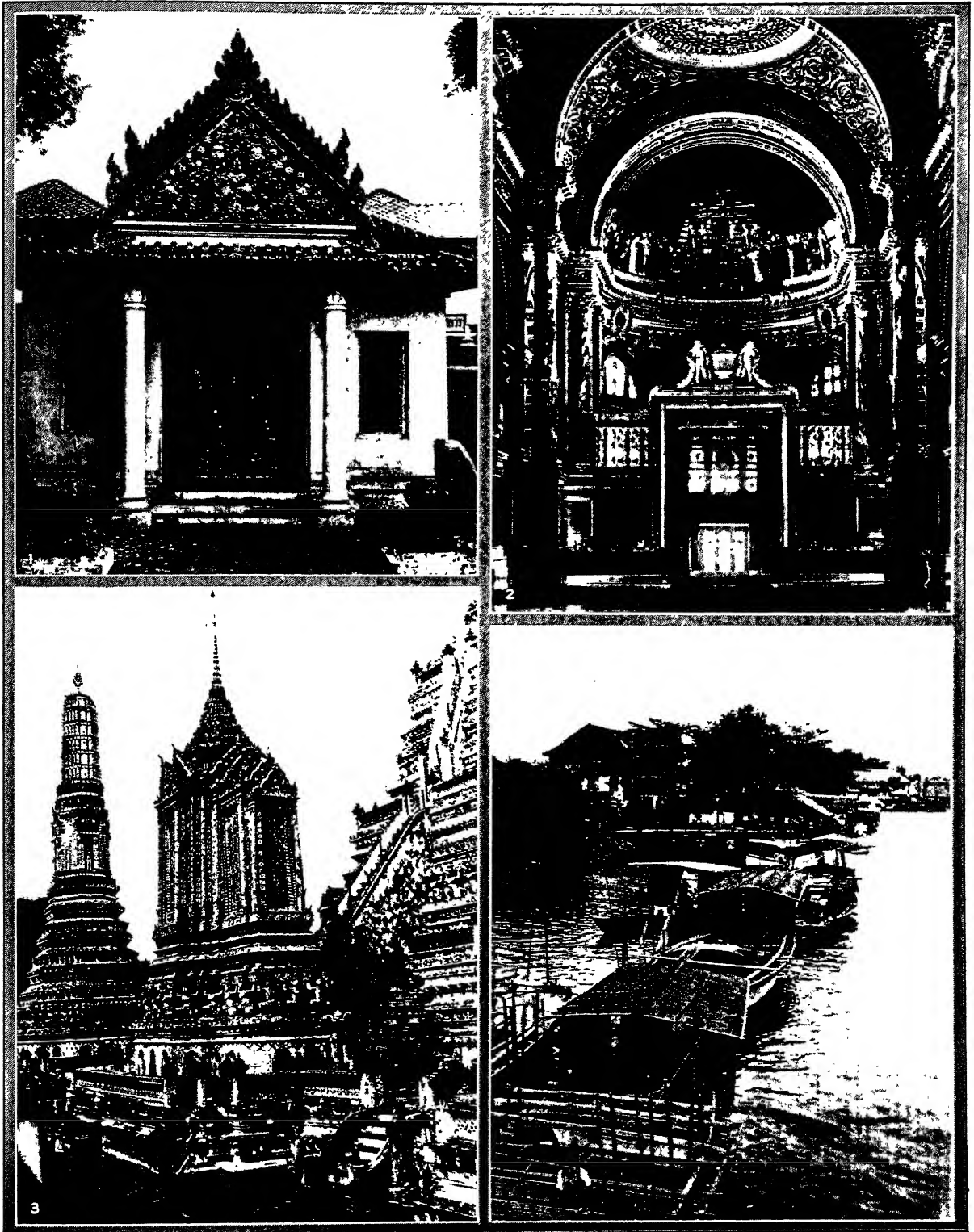
SIBELIUS, JOHAN JULIUS (Jean) (1865-), Finnish music composer, was born at Tavastehus, Dec. 8, 1865. After a brief term as a law student, he studied music at the Helsingfors Conservatory, where, in 1893, he became a teacher, and in Germany with Becker, Fuchs, and KARL GOLDMARK. His works are based largely on Finnish folk-songs, and his opera *The Maid in the Tower* is the first distinctly national opera of Finland. The most popular of his compositions are the symphonic poem *Finlandia* and a deft *Valse triste*. Eight symphonies, a violin concerto, more than two score of songs, and numerous choruses are included in his other compositions. His works are generally virile and marked by technical development of a high order.

SIBENIK. See SEBENICO.

SIBERIA, formerly a single administrative unit of Asiatic Russia, part of the R.S.F.S.R., organized in 1925 and comprising the Altai, Omsk, Tomsk, Novo-Sibirsk, Yenisei and Irkutsk provinces, and the Oriat Autonomous Area. Its area of 1,880,708 sq. mi. extends from the Arctic Ocean between Gyda and Khantanga Bay in the north to Mongolia and Kazakstan in the south. Physically, it divides into a low western and a high eastern section, touching on the Yakut territory. The western Siberian plain stretches from the Ural border to the Yenisei River; the sandy tundras of the north are succeeded by fertile forest-tundras amid marshes and lakes. In the south are the steppes, which become increasingly hilly as they approach the Altai Mountains with their deep forests, gorges, glaciers and mountain lakes. The eastern section is composed of plateaus intersected and encompassed by mountain ridges. Lake Baikal, the mighty Yenisei, the Irtysh and the Ob are the region's great waterways.

In July 1930 Siberia was divided into two regions. The Western Siberian Region, with Novo-Sibirsk as administrative center, has an area of 503,644 sq. mi. Pop. 1930, 8,135,500. The Eastern Siberian Region includes the section south and east of Buryat S.S.R. bordering on Mongolia, formerly contained in the Far Eastern Area. IRKUTSK is the administrative center. The area is 1,377,064 sq. mi. Pop. 1930, 2,304,515. Siberia's northern situation and its distance from the sea give it the coldest winters in the world, although the summers are extremely warm for the latitude, and permit the development of agriculture. Many species of bears, foxes, seals, wolves, lynxes, sables, ermines, deer, otters, squirrels and other animals are numbered among the fauna; their furs and

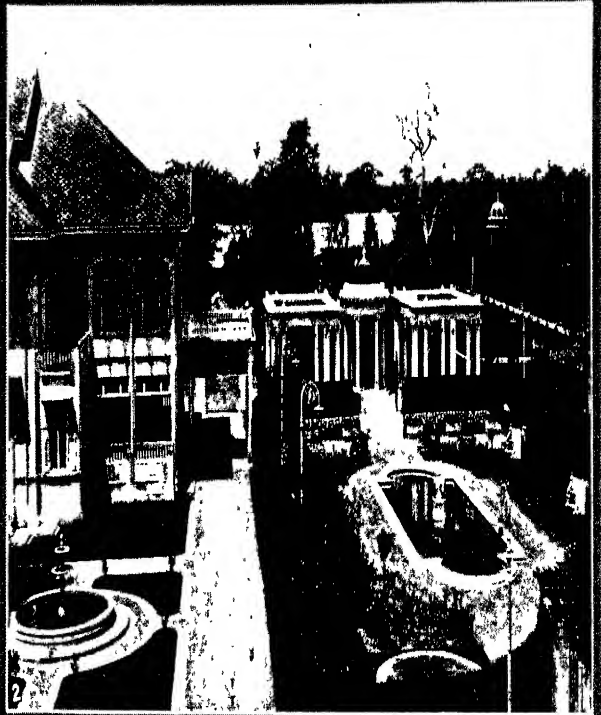
SIAM



1, 2, COURTESY CONSULATE GENERAL OF SIAM; 3, 4, HAMBURG-AMERICAN LINE

ASPECTS OF SIAMESE LIFE

1. Temple gate in Bangkok.
2. Interior of the Throne Hall, Bangkok.
3. Part of the Wat Arun or Chang, a Siamese temple, Bangkok.
4. Chain of boats on a *long* (canal), used by the Siamese peasants and Chinese in transporting goods.



1, 2, COURTESY CONSULATE GENERAL OF SIAM; 3, 4, HAMBURG-AMERICAN LINE

SIAM, KINGDOM OF THE FAR EAST

1. The Buddhist Wat, or Temple, Benjama Rajabopit, in Bangkok, where the King of Siam worships each year. 2. Fountains in the rear of Phya Thai Palace Hotel, Bangkok.
3. Siamese women in the classical attitudes of the dances of their country. 4. Elephants, a common means of passenger transportation in Siam.

hides constitute a good percentage of the region's wealth. Birds of diverse kinds are numerous in the steppe country.

Russians are in the majority. The original inhabitants are Samoyedes and many Turkish, Tatar and Kirghiz tribes. The sparse population is chiefly concentrated along the big rivers or the Trans-Siberian Railway running from Cheliabinsk to Vladivostok.

Siberia is almost inexhaustibly rich in natural resources; its dense forests have scarcely been touched and in the Kuznets and Tunguska regions are magnificent, while unexploited coal deposits, iron, gold and copper are items of mineral wealth. Agriculture leads all other occupations and engages seven-eighths of the populace. Wheat, mainly for export, is the principal growth. Dairying and cattle breeding are well-developed. Industries, relatively unimportant, include glass and rope factories in the cities; handicrafts are weaving, woodworking and metalwork and the dressing of hides and furs. Novo-Sibirsk, OMSK, TOMSK, BARNAUL and Krasnoyarsk are the chief centers. Total population of the two Siberian regions, 1930, 10,490,015.

SIBERIAN EXPEDITION, the inter-Allied expedition to Siberia in 1918-1920. Partly as a move to rescue the Czech army and partly to check the spread eastward of the Soviet troops, an inter-Allied expedition was sent into Siberia in Aug. 1918. American, Japanese, British, French and Italian troops entered through Vladivostok, and penetrated well into the interior. All except the Japanese troops were withdrawn before the end of 1920, but these remained until late in 1922. Considerable uneasiness was created by the fact that Japan sent in many more troops than had originally been agreed on with the United States—the Japanese sent 70,000 altogether—and because the Japanese troops remained so much longer than the others. The American Government put considerable diplomatic pressure on the Japanese Government before the Japanese troops finally were withdrawn.

SIBIU (Hermannstadt, Hungarian Nagyszeben), on the Zibin River, capital of the district of the same name in Transylvania, Rumanian since 1919, consisting of the upper city with the King Ferdinand Ring, the lower city and 5 suburbs. Of the old fortifications 2 bastions and 5 towers remain. Among the churches, the most noteworthy are the 14th century Gothic Protestant church, with a museum of ecclesiastical antiques and Transylvanian-Saxon folklore, the former Jesuit church built in 1763, and the modern Greek Oriental cathedral. Among the other buildings are the 15th century city hall, the Brukenthal Palace with a library and the largest collection of paintings in Rumania, including collections of etchings, miniatures and antiques, and a scientific and historical museum and the archives of the Saxon nation. It is the seat of the Lutheran bishop, the Greek Oriental Metropolitan, and of the association of Germans in Greater Rumania. There are also many schools, including theological seminaries. The chief

products are machines, cloth, footwear, starch and earthenware. The trade is chiefly in agricultural products and cattle. Founded by German colonists about the 12th century, it was destroyed by Mongols in 1241, revived and became the center of Saxon Transylvania. The city played a part in the Turkish and World Wars. Pop. 1930, 49,000.

SIBLEY STOVE TENT, a conical tent to accommodate eight men, with a central pole whose base is a triangular frame set up over a truncated conical sheet-iron stove, the pipe of which passes through the apex of the tent. It is used in semi-permanent camps.

SIBYL, in classical mythology, any one of the number of seeresses, priestesses of APOLLO, who dwelt in different parts of the world. The most famous was the Cumaean, who directed AENEAS in his visit to the lower regions, and who sold Tarquin the three Sibylline Books, which were kept in the Temple of Jupiter on the Capitoline Hill until the temple was burned.

SICHOMOVI, one of the pueblos of the HOPI, situated on the east mesa of Tusayan, between the pueblo of Hano and Walpi, in northeastern Arizona. Sichomovi was established by Badger clan migrants from another of the Hopi villages, Walpi, in 1750, and was joined later by some Tanoan peoples from New Mexico.

SICILIAN VESPERS, the popular rising of the Sicilians against Charles of Anjou. It received the name from having broken out at Vespers, Easter Tuesday 1282. Charles of Anjou had been invested with Sicily by Pope Urban IV and had driven out the Hohenstaufen Manfred in 1266. Not only was Sicily strongly attached to the family of Frederick II, but Charles's rule goaded them further. The Vesper rising was first a popular movement, but later was supported by Peter III of Aragon, husband of Manfred's sister Constanza. The French were slaughtered or driven out and the Aragonese dynasty accepted. See SICILIES, KINGDOM OF THE TWO.

SICILIES, THE KINGDOM OF THE TWO, was originally built up by Norman conquerors who seized the mainland of south Italy from Lombard and Byzantine lords and the island of Sicily from the Saracens during the 11th century. This kingdom passed to the house of Hohenstaufen; but with the fall of the Emperor Frederick II the Papacy invited Charles of Anjou to take the throne as a fief of the Holy See. Charles conquered both mainland and island by 1266, but as a result of the SICILIAN VESPERS he lost Sicily to the Aragonese dynasty in 1282.

This division lasted until the death of Joanna II in 1435, last of the Angevin sovereigns of the mainland, when Alphonso of Aragon, King of insular Sicily succeeded to the mainland as well. Thus the Sicilies passed to Spain and so remained until in the WAR OF THE SPANISH SUCCESSION the mainland was given to Austria and the island to Savoy. In 1720 Austria traded Sardinia for Sicily, but in 1735 both Sicilies were turned back to Spain. The Two Sicilies

thereafter were ruled by younger members of the Spanish royal family until the mainland was occupied by the French in 1799 and organized in 1806 as the Kingdom of Naples under Joseph Bonaparte. In 1808 Joseph became King of Spain and was succeeded in Naples by Murat, brother-in-law of Napoleon, who was in turn overthrown at the fall of Napoleon and the Spanish Bourbons restored.

The Kingdom of the Two Sicilies, now reformed, continued as an unstable anomaly in the 19th century facing revolts on the mainland in 1821 and in Sicily in 1848. At length, rotted by its own feebleness and undermined by the ideal of a united Italy, the kingdom fell an easy prey to Garibaldi who, with secret aid from Sardinia, landed at Palermo in May 1860. By August he had conquered the island and crossed to the mainland, and on Sept. 7, he entered Naples, annexing the Sicilies to Sardinia, which in 1861 became the Kingdom of Italy.

SICILY, largest island of the Mediterranean, forming the "toe" of the Italian Peninsula, situated between lat. 36° 38' and 38° 18' N., and separated from the Italian mainland by the Strait of Messina. It covers a mountainous area of 9,935 sq. mi., divided into nine departments. Sicily is generally triangular in shape, the apex pointing south. The maximum altitude is that of Mt. Etna in the north, an active volcano which rises to 10,758 ft. The east and north coasts are rocky. South of Mt. Etna is the plain of Catania, traversed by the Simeto or Giarretta River.

Sicily is a great fruit- and vegetable-producing region. The districts along the coast are devoted to the raising of grapes, olives, oranges, lemons, and a large variety of other fruits. Farther inland quantities of pears and beans are raised. Of mineral products sulphur is the most important, although salt, asphalt and pumice stone are mined in considerable quantity. Fishing is an extensive industry which engages nearly 50,000 people. Other industries include the preparation of citric acid, wines, olive oil and the manufacture of furniture and laces in PALERMO, the capital and largest seaport. Other important cities are CATANIA and SYRACUSE. Pop. 1928, 4,426,113.

SICKNESS STATISTICS. Statistics on general sickness are as yet very unsatisfactory. The most useful available data relate to the industrial population for which considerable material has been collected. European countries have, in this respect, a considerable advantage with their established systems of compulsory health insurance but thus far little practical use has been made of the immense experience which has been had. In Germany in 1927 the ratio of insured persons to one case of sickness was 1.9, or respectively 1.8 for men and 2.1 for women. The ratio of one case of sickness to the number of days sickness was 23.3 or 21.5 for men and 26.4 for women.

For the United States the most careful study has been made by the U.S. Public Health Service for the city of Hagerstown, Md. The study was begun in

1921 and has been continued year after year. That office has also published important papers among industrial employees including an analysis of the experience had among 163,000 persons for the period 1921-1928. The relative frequency of claims for sick benefits show that of the total morbidity 9.8% was due to external causes, 42.4% to respiratory diseases, 13.5% to digestive diseases, 6.9% to circulatory and genito-urinary diseases, 5.8% to rheumatism, 4.4% to diseases of the nervous system, 3.8% to diseases of the skin, 3.3% to diseases of organs of locomotion, 2.6% to epidemic and endemic diseases and 7.5% to all other diseases. The average rate of sickness and non-industrial injuries during the period under review was 103.5 per 1,000 men. Of these, non-industrial injuries accounted for a rate of 10.2, and all sickness, 93.3, and of these, respiratory diseases accounted for 43.9 per 1,000, nonrespiratory diseases, 49.4, influenza, 21.8, pulmonary tuberculosis, 1.4, bronchitis, 5.7, pneumonia, 3.3, diseases of the pharynx and tonsils, 6.3 and other respiratory diseases 5.4.

The economic aspects of sickness have of late years attracted much attention, particularly through the work of the National Committee on the Cost of Medical Care. The reports of that committee are an extremely valuable source of useful information. They include a survey of average expenditures of persons having medical care, made by the Metropolitan Insurance Company for the period Jan.-June, 1929. That study reveals that the average expenditure per family amounted to \$70.00, and per person, \$13.48. The Committee presents an estimate on the basis of 36,000,000 wage earners in the United States who were stated to lose at least 250,000,000 working days per year. But in addition, 24,000,000 school children lose 170,000,000 days during the school year. The investigation makes it entirely clear that mortality statistics cannot be used for the purpose of illustrating the extent of sickness.

F. L. H.

SICULIAN, an extinct INDO-EUROPEAN language of Sicily, preserved in a few glosses and inscriptions. Its linguistic affinities are uncertain, but it may have belonged to the LIGURIAN family.

SIDDON'S, SARAH (1755-1831), English actress, was born in Brecon, Wales, July 5, 1755, the eldest daughter of Roger Kemble, a strolling player, and sister to the actors, John Philip and CHARLES KEMBLE. She appeared on the stage as an infant, but at 15 she was sent into domestic service. She returned to the stage in 1773 and with her husband joined the Drury Lane company, under DAVID GARRICK. Mrs. Siddons made an unsuccessful début in that theatre, Dec. 1775, as Portia. The Siddons then played at the Theatre Royal, Bath, 1778-82. In 1782 she returned to Drury Lane, as Isabella, in Southerne's *The Fatal Marriage* with a first-night triumph only comparable to those of Garrick and EDMUND KEAN. Her greatest parts were as Lady Macbeth, Queen Katherine and Volumnia. Reynolds, Gainsborough and other artists painted her, and she was courted by the highest society of the time. Mrs. Siddons has been said to represent the

greatest achievement in the arts by any of her sex in England. She died at London, June 8, 1831.

SIDE BANDS, the RADIO FREQUENCIES associated with a CARRIER FREQUENCY when the carrier is modulated. Both mathematical analysis and experiment show that, when the amplitude of a high-frequency current is controlled in any manner, as in the case of MODULATION of a carrier current by power at AUDIO FREQUENCIES, not only is the original frequency present but also two additional frequencies for each frequency involved in the modulation. One of these frequencies is the sum of the high and low frequencies, the other is their difference. See also RADIO COMMUNICATION.

SIDERITE, an unimportant ORE of iron, consisting of the iron carbonate. Gray when freshly broken, it rapidly oxidizes to brown. Siderite is closely related to CALCITE, DOLOMITE, MAGNESITE, RHODOCHROSITE and SMITHSONITE, crystallizing like them in the HEXAGONAL SYSTEM.

Siderite occurs in massive, granular, earthy, fibrous and botryoidal forms. It is sometimes found in veins, in limestone and clay, and in gneiss and slates. Clay ironstone is a clayey siderite. Siderite is obtained in Switzerland, Germany, England, France, and in New York, Pennsylvania, Ohio, and Kentucky. See also ORE DEPOSITS; GANGUE; OCHER.

SIDEROSTAT, an instrument similar in purpose to the COELOSTAT and the HELIOSTAT, enabling a certain portion of the sky to be viewed continuously without changing one's position. In the polar siderostat, the observer looks through a TELESCOPE toward the earth in the direction of the polar axis, onto a MIRROR which can be so oriented that any portion of the sky may be viewed without changing the position of the telescope.

SIDE SHOW, an added feature of a circus. Here are exhibited, generally at an extra admission charge, the freaks and strange animals, many of which have not been seen in the regular performance. The assemblage usually includes, among others, an exceptionally tall man and an equally short one, a very fat person and a very thin one, a snake charmer, and an Indian fakir who can swallow glass and sit calmly on spikes. It is customary for the patrons to be escorted by a guide who stops before each exhibit and explains that particular attraction, while the performer displays his special qualities.

SIDGWICK, ELEANOR MILDRED (1845-), English educator, was born in Scotland, Mar. 11, 1845, the sister of ARTHUR JAMES BALFOUR. In 1876 she married Henry Sidgwick and shared his interest in higher education for women. They were instrumental in founding Newnham College, Cambridge, of which Mrs. Sidgwick was principal from 1892-1910. She was made secretary of the Society for Psychical Research in 1910 and in 1915 was president of the educational section of the British Association. In 1890 she published *Health Statistics of Women Students*.

SIDI-BEI-ABBES, Africa, an Algerian town in the department of Oran. It is situated on the Mekker

River, occupying a stretch of ground 1,552 ft. above sea level. Walls, pierced by 4 gates, encompass the town which is quite modern, having broad, shaded streets and many fountains. A railway connects it with the town of Oran, which lies 35 mi. to the north. There is an active trade in agricultural products, particularly cattle, alfalfa and wine. Pop. 1926, 43,148.

SIDNEY, SIR PHILIP (1554-86), English poet, statesman and soldier, was born at Penshurst, Kent, Nov. 30, 1554. Sidney in his versatility was typical of his period. After leaving Oxford he traveled on the Continent in the interests of Queen Elizabeth, and in Paris witnessed the St. Bartholomew Massacre. While in Venice he sat for PAOLO VERONESE, the painter. His diplomacy was aided by his engaging personality, and he was permitted to address the new Elector Palatine and Emperor, advocating a Protestant league against Spain, and a Church conference. Again in England, he was involved in Leicester's downfall, and in his banishment from court began his *Arcadia*, and wrote the *Astrophel* and *Stella* sonnets, the first important English collection in that form. Sidney's *Apologie for Poetrie*, rebutting Gosson's attack on the stage, appeared about 1581, and in 1583 Elizabeth made him knight. He was given a command in the Netherlands, and in the field against Zutphen was struck by a bullet in the thigh. It is related that on seeing the Lord Marshal without his greaves, Sidney had discarded his also, and that he refused a cup of water in favor of a dying soldier. All his works were published posthumously. He died at Arnheim, Oct. 17, 1586, greatly mourned, and was buried in St. Paul's.

SIDNEY, a city in western Ohio, the county seat of Shelby Co., situated on the Miami River, 31 mi. south of Lima. It is served by trolleys and two railroads. The surrounding country is a good farming region. Sidney is an industrial center, manufacturing washing machines, automobile bodies and other kinds of machinery. It has large tanneries, nurseries and packing plants. The city was plotted in 1819, and named after Sir Philip Sidney; it was chartered in 1897. Pop. 1920, 8,590; 1930, 9,301.

SIEGEN, a German city in the Prussian province of Westphalia, situated on the Sieg River about 50 mi. east of Cologne. It became a city in 1317, belonging half to Nassau and half to the archbishopric of Cologne, then to Nassau-Orange. From 1606 to 1743 it was the seat of the line Nassau-Siegen; from 1806 to 1815 it belonged to the grand duchy of Berg, and in 1815 became Prussian. Siegen is the birthplace of the famous Dutch painter, PETER PAUL RUBENS. The city has a mining school. The 15th century Church of St. Nicholas is notable. Siegen has important iron and steel industries, zinc mines, furnaces, sheet metal and boiler works. Trade in machine tools, sheet iron and grain is carried on. Pop. 1925, 31,205.

SIEGE OPERATIONS, the establishment of an armed force before or around a fortified place for the purpose of taking it by continuous offensive operations, such as direct assault and the breaching, under-

mining or scaling of the defensive works, and by breaking the defenders' will to resist by cutting off their supplies. The first operation of a siege is an investment to interrupt communication with the outside. Wellington's sieges, during the Napoleonic Wars, were remarkable for his escalating operations and desperate assaults of breaches. Of twelve assaults, five only were successful. Where Napoleon commanded in person, he generally contented himself with a complete investment and avoided desperate assaults, trusting to the slower but surer and less costly operation of famine. In the Middle Ages, a town once fortified came to be regarded as a place that must be defended. This habit of thought has not wholly disappeared; but skilful commanders in all ages have avoided being invested by giving up cities, towns, and villages which they could no longer defend without submitting to investment. In 1864 and 1865, the meeting engagements of the earlier years of the Civil War were changed into the trench warfare and siege operations of Spottsylvania, the North Anna, Richmond, Petersburg and Atlanta; but the Confederate commanders wisely retreated in each case before complete investment could take place. As a general principle, the garrison required to hold an isolated fortress, cut off from exterior sources of supply, is more valuable to a country than the fortress it defends. To preserve his liberty of action, a commander-in-chief may find it necessary to sacrifice detachments by requiring them to hold certain places, such as naval bases, at all costs; but he should keep his command as a whole, free to maneuver in the field, with a view to its eventual employment in the offensive. S. C. V.

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SIEGE PERILOUS, THE, in the ARTHURIAN LEGENDS, the place or "siege" at the Round Table reserved for that knight who should achieve the quest of the HOLY GRAIL. The siege, called perilous because death instantly struck any false pretender who dared to sit there, eventually became Sir Galahad's.

SIEGFRIED. See SIGURD.

SIEGFRIED, an opera by RICHARD WAGNER, one of a cycle of four music-dramas; see NIBELUNGEN, RING OF THE.

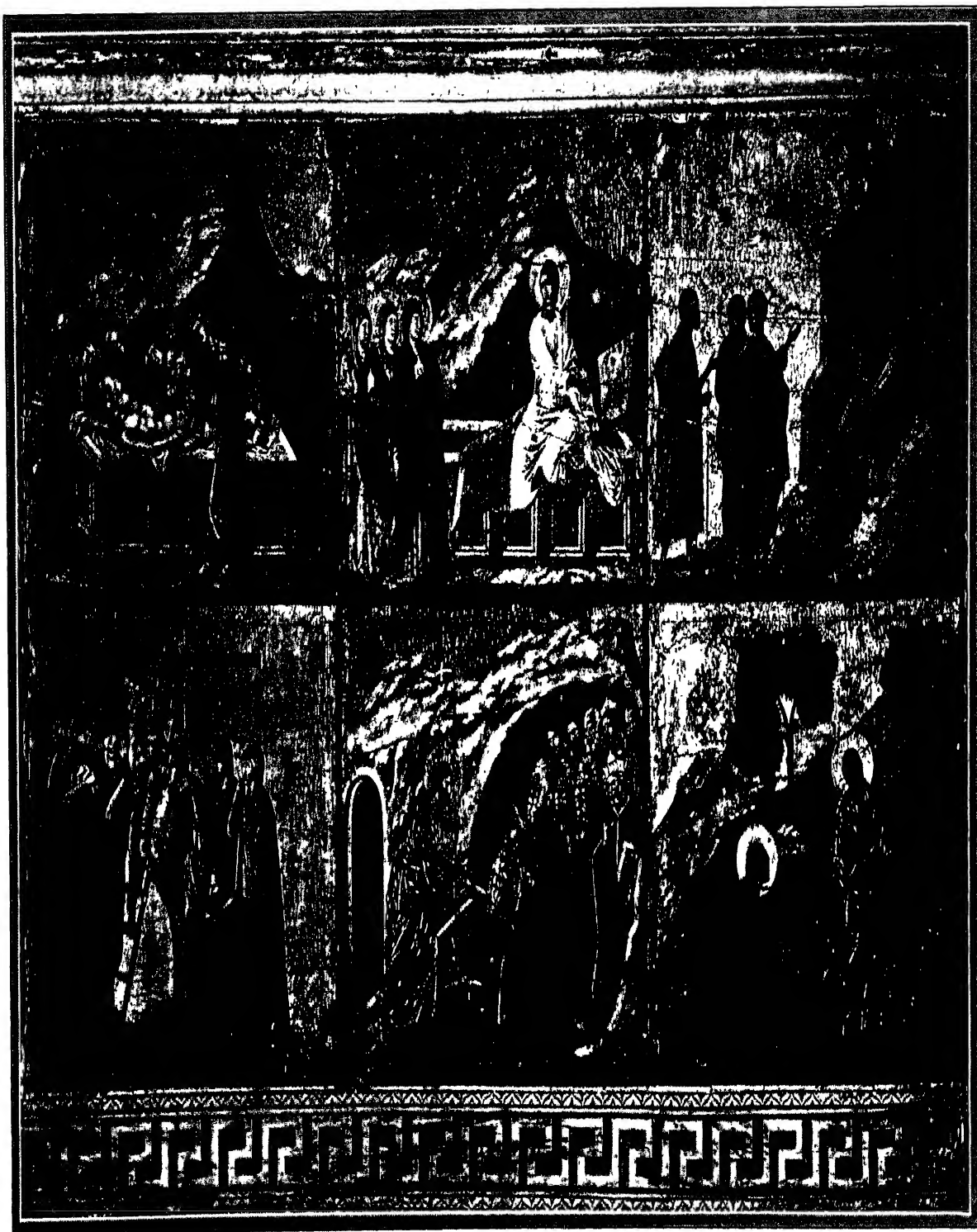
SIEMENS, ALEXANDER (1847-1928), naturalized British electrical engineer, was born in Hanover, Germany, Jan. 22, 1847. After technical studies at Berlin and Hanover in 1867 he began his career in the laboratories of Siemens Brothers, Woolwich, the British concern made famous by his uncles, Sir Wilhelm Siemens and ERNST WERNER VON SIEMENS. As a member of the firm, Siemens aided in the construction of the Indo-European telegraph line to Persia, and in 1869 helped to lay a cable across the Black Sea. He fought in the Franco-Prussian War, returned to England, and in 1878 became a naturalized citizen. With Sir Wilhelm Siemens he was coinventor of the regenerative furnace. He died at London, Feb. 19, 1928.

SIEMENS, ERNST WERNER VON (1816-92), German engineer and electrician, was born at Lenthe, Germany, Dec. 13, 1816. He was graduated from the Lubeck gymnasium, and from 1838 to 1848 served as an artillery officer. In 1849 he built the first great telegraph line on the Continent, from Berlin to Frankfort-on-Main. With his brother Karl, he established in London the firm of Siemens Brothers, which laid six Atlantic cables. Siemens discovered the use of gutta-percha as an insulator, constructed telegraph apparatus, invented the pneumatic-tube system, and made other valuable applications of electrical force. He established a technical school at Charlottenburg with a gift of 500,000 marks. He died at Berlin, Dec. 6, 1892.

SIEMENS, SIR KARL WILHELM (1823-83), naturalized British inventor, engineer and physicist, was born at Lenthe, Hanover, Apr. 4, 1823. He was educated at the University of Göttingen, and in 1843 went to England to introduce his method of electroplating. He obtained English citizenship in 1859. With his brother, Ernst Werner von Siemens, he invented the process by which steel and iron are made directly from the ore. In 1862 he was elected to the Royal Society, and was knighted in 1883. He died at London, Nov. 19, 1883.

SIENA, a city of Italy, capital of the province of the same name in Tuscany, west central Italy, seat of an archbishop and of a university famous in the 14th century. It is one of the picturesque hill towns. The 13th and 14th centuries witnessed the rise of the Sienese school of painting. The cathedral and numerous palaces are splendid monuments of Gothic architecture. The cathedral, famous for its inlaid floor on which Biblical scenes are represented, was begun in the first half of the 13th century and completed early in the 14th. Priceless works of art by MICHELANGELO, DONATELLO and other great men are in the splendid interior. Other noteworthy churches are the Gothic San Domenico, 1293-1391, Santo Spirito, 1345, the Church of St. Catherine of Siena, and the Baroque Church of Santa Maria di Provenzano. Prominent palaces are the 13th century Palazzo Pubblico and the former Piccolomini Palace, 1469-1500. The city is adorned with numerous beautiful loggias and fountains. Known to the Romans as *Saena Julia*, Siena was in medieval times one of the finest cities in Tuscany and the leader of the Ghibelline faction in Central Italy. In 1260 the Sienese gained a victory over the Florentines near Montaperti. In 1557 Siena fell to Florence. The chief industrial plants of the modern city are railroad shops, antimony works, iron and machine factories, tanneries and printing plants. Pop. 1931, 47,688.

SIENESE SCHOOL OF PAINTING, founded by Duccio in the 14th century and the instructor of the Florentine and Umbrian schools in their beginnings. The school stands as the culmination of the Byzantine tradition from which it never departed to follow the naturalistic trend of the era. The chief characteristic of the school was the almond-eyed ma-



DUCCIO DI BUONINSEGNA'S ALTAR PAINTINGS

Six scenes from the Passion of the life of Christ, part of the famous altarpiece of the Siena Cathedral.

donna, with a detached, pensive loveliness, in a setting of sumptuous clothing, and a rich gold and color background. An exalted sentiment rather than realistic form or precise technique was the ideal. While producing no great masters the school was prolific and by the middle of the 15th century had exhausted itself and was merged into the UMBRIAN SCHOOL. Simone Martini, pupil of Duccio, was followed by the Lorenzetti, Taddeo Bartolo and Lippo di Memmi. Later artists were Sassetta, Matteo Giovanni and Francesco Giorgio. A fresh impulse was given at the end of the 15th century by Sodoma.

SIENKIEWICZ, HENRYK (1846-1916), Polish novelist, was born in 1846 near Lukow, Russian Poland. He was educated at Warsaw University. World-wide fame came to him with the publication of *Quo Vadis?* in 1895. It was at once translated into English, and has been successfully dramatized and filmed. Translation into more than 30 languages followed. Previously Sienkiewicz had published a trilogy, *With Fire and Sword*, *The Deluge* and *Pan Michael*, which had wide circulation in English. In 1905 he received the Nobel Prize for Literature. He died in Switzerland, Nov. 15, 1916.

SIERRA LEONE, a British colony and protectorate on the west coast of Africa. The colony itself has an area of 4,000 sq. mi. and extends along the coast for 180 mi. between French Guinea and Liberia, the hinterland forms the protectorate of 27,000 sq. mi. Pop. of colony, 1921, 85,163; of protectorate, 1,456,148.

The inhabitants, except for 1,161 Europeans, are mainly native tribes, including some Fula and Mandingoes. There are pockets of "colony Africans," or descendants of liberated slaves. All slaves, numbering about 250,000, held by natives were declared free on Dec. 31, 1927.

The oil-palm belt is chiefly in the northeast and east. Large areas are untraversed, as head-porterage is the only means of transport. The kola tree grows wild and is also cultivated; its nuts are an important export. Rice is the staple food, and high yields are obtained. For a long time cotton has been carelessly grown and cocoanuts are extensively raised. Platinum was recently discovered and iron ore is mined.

Freetown, with a population of 44,142 in 1921, has the best natural harbor in west Africa. The territory is administered by a governor and has been in possession of the British since 1788.

SIERRA MORENA MOUNTAINS, a mountain chain of Spain on the Iberian plateau or meseta, extending east to west. On the southern slope, near Linares, are rich copper mines, while the central mountains yield mercury, silver and lead. The Sierra Morenas lie at an elevation of about 2,500 ft., rising 1,000 to 2,000 ft. above the plateau. At the easternmost ridge is Sierra de Alcares, reaching 5,900 ft. The Madrid-Cordova railway pierces through several tunnels at the picturesque Puerto de Despenaperros, the principal pass. The mountains, which are the watershed between the Guadiana in the north and the Guadalquivir in the south, have played an important

part in Spanish history in separating Andalusia from Extremadura and New Castile.

SIERRA NEVADA MOUNTAINS, a mountain range 25 mi. broad in southern Spain, running for 60 mi. parallel to the Mediterranean, through the province of Granada to the frontier of Almeria. Viewed from the Mediterranean the mountains appear to rise abruptly since the crest lies only 28 mi. distant. The range constitutes part of the great watershed which separates the waters flowing to the Mediterranean from those flowing to the Atlantic. Mica slate is the chief rock constituent of these mountains, which fall as a sheer precipice on the north and slope with a gradual incline on the south and southeast. The name Sierra Nevada, which means "snowy peaks," is due to several of the peaks which rise above 10,000 ft. and are covered with snow during the entire year. Mulahacen, over 11,420 ft. high, situated 20 mi. southeast of the city of Granada, is the highest peak. There is none higher in Europe except in the Alps. The Picachi de Veleta, a near-by peak, towers to a height of more than 11,000 ft. and affords one of the most splendid views in Europe. Piercing these heights are deep valleys or ravines, with small icy lakes scattered among them, of which one, the Corral de Veleta, extends into a glacier, 8,580 ft. high. This glacier lies farther south than any other in Europe. There is a luxuriant vegetation of olives, chestnuts and oranges in the lower valleys of this bare mountain, the main body of which is snow-covered most of the year.

SIERRA NEVADA MOUNTAINS, range situated directly inside the eastern boundary of California. Beginning at about 40° 20' N. lat. where the Cascades end, the Sierra Nevada continues in a south-southeasterly direction to 34° 50' N. lat., a little more than 400 mi. On the west it overlooks the great California valley and at the southern end curves strongly to the west under the name of Tehachapi, the southeastern slope of which overlooks the Mohave desert. The notable features of the range are the straightness of its base, the absence of transverse spurs and the exceedingly steep eastern slope overlooking the Great Basin. The crestline is near the eastern margin and where the range is highest the average slope from crest to foot is more than 1,000 ft. per mile. The general summit level varies from about 8,000 ft. at the north to 12,000 and 14,000 ft. in the high Sierras at the south. Here the loftiest peaks include Mt. Whitney, 14,496 ft. the highest elevation in the United States, Mt. Tyndall, 14,025 ft., Mt. Williamson, 14,384 ft. and many others exceeding 14,000 ft.

The principal streams rising in the Sierra Nevada flow down the long western slope in canyons 4,000 to 5,000 ft. deep, among which is the Yosemite valley on the upper course of the Merced. The central section of the range known as the Gold Belt has been one of the leading gold producing areas in the United States since the famous gold rush of 1849.

SIÉYÈS, EMMANUEL JOSEPH COMPTE (Abbé Siéyès) (1748-1836), French statesman, was

born at Frejus, May 4, 1748. He was educated by the Jesuits, studying theology at the University of Paris. He took an active part in the revolutionary movement of the late 18th century, publishing several pamphlets on political aspects of the day, notably the one on *What is the Third Estate?* He was elected to the Constituent Assembly and participated in the formation of the National Assembly. As a Paris deputy to that body he introduced many enlightened measures and was responsible for the division of France into departments. The Abbé opposed the excesses of the Reign of Terror and anxious for the re-establishment of law and order he supported Napoleon in 1799. The pair plotted the revolution of the 18th Brumaire which led to the Consulate. Siéyès furnished the elaborate plan for the constitution which Napoleon modified to make it suit his purpose. Once master, the Corsican dispensed with Siéyès politically, giving him 600,000 francs and an estate, to which the Abbé retired a much disillusioned man. He died at Paris, June 20, 1836.

SIFTING COMMITTEE. See CONGRESS OF THE UNITED STATES.

SIGHT, SENSE OF. See EYE.

SIGHT DRAFT. See BILL OF EXCHANGE.

SIGHTS, GUN. See GUNSIGHTS.

SIGILLARIA, a genus of large Carboniferous trees, representing with *LEPIDODENDRON* the climax of Lycopod (club-moss) development. They were more grotesque than the latter, from which they are distinguished by the vertical arrangement of the leaf-base scars, or seals, from which they are named. Many species, some barrel-shaped, others slender, were unbranched. Swordlike leaves stood upright on their summits in a huge brush. The peculiar bifurcated roots were of the *STIGMARIA* type.

SIGISMUND (1361-1437), Holy Roman Emperor, was born in 1361, the son of the Emperor Charles IV. He became margrave of Brandenburg in 1378 and, after his marriage to the daughter of the king of Poland, was crowned king of Hungary. Leading the Christian forces against the Turks, he was defeated by *BAJAZET I* in 1396. In 1410 Sigismund was elected emperor of Germany, and nine years later became king of Bohemia. He convened the Council of Constance at which *JOHN HUS* was condemned to death. Sigismund was crowned Holy Roman Emperor by the Pope in 1433, and died in 1437.

SIGNAL COMMUNICATIONS, ARMY, a systematized arrangement indispensable to a modern army. Within the zone of the interior, military administration, mobilization of forces and supplies and the service of information employ the existing electrical communication facilities of the country. These facilities are expanded to serve added military establishments. They are supplemented, where necessary, by special military installations.

Within the theater of operations, all troop units and their auxiliary establishments, such as depots, railheads, hospitals and airdromes, are connected by a complete system of wire lines providing universal

telephone service and a telegraph service to division and larger units. In the regiment and in each successive larger unit a radio net (*see* RADIO TRANSMITTING SET) supplements the wire system to insure unbroken communication during interruption to wire service. Orders for troop disposition and movement, the exercise of command in the larger units, military intelligence and the service of supply are largely handled by these nets.

Special radio nets are operated for the RADIO COMPASS and intercept service; between AIRCRAFT and ground for observation and for the regulation of ARTILLERY fire; and between air units for tactical control. Separate wire nets are allocated to the system of antiaircraft defense. Meteorological reports, for their collection and dissemination, usually require special wire and radio circuits or time schedules.

The equipment used by troop units in the field is largely special in form to meet the military requirements of portability, resistance to hard usage and of being entirely self-contained as to operation. Since the advent of radio, visual signalling methods have been largely discontinued.

In the U. S. Army a separate arm, the signal corps, is charged with the furnishing of the general signal communication service and the development and supply of all technical equipment for that purpose.

G. S. G.

SIGNALLING, a term applied to the transmission of information by visible movements, sounds or electrical impulses in accordance with a prearranged system, or code. Signalling is employed where verbal or written communication is impossible or inadvisable. Several types of visual signalling are used, some of which date from ancient times. Uncivilized peoples employed fire and smoke to indicate danger or to give the signal for an attack. The Romans sometimes used arrangements of torches to transmit messages by code. The first step in the development of modern methods came during the latter part of the 18th century when flag signalling was introduced, and now flags are not uncommonly used in maritime signalling, conveying a message by their color or position. In SEMAPHORE signalling, words are spelled out by using two flags whose various positions represent letters of the alphabet according to a code. Flash signalling by code is widely used in modern military and maritime communication. Powerful lights and the HELIOGRAPH, which reflects sunlight, are employed to produce flashes corresponding to dots and dashes as used in the MORSE CODE and are useful in transmitting detailed information. Rockets, Roman candles (*see* FIREWORKS) and VERY PISTOLS are employed for indicating distress, and, in war, for showing the position of the infantry and in calling for fire support from the artillery.

The most recent development in visual signalling is that affording communication between an airplane and the ground, employed chiefly in war maneuvers. Information is signalled from the ground to the plane by arranging large sheets of canvas on a flat surface

in accordance with a code. The pilot conveys his message to the ground station by tilting the wings, diving, banking and by other maneuvers which have prearranged meanings. This method is employed only in the absence of facilities for wireless communication between the plane and the ground.

Sound signalling is often used by ships. Messages may be sent by code by firing a gun at regulated intervals, by blowing long and short blasts on a steam whistle, and by sounding a siren. The most modern sound transmission is effected under water. The signals are given by an electrically operated oscillator and received by a MICROPHONE in the hull of the ship. This operates satisfactorily for distances up to 12 mi.

ELECTRIC SIGNALLING by wired and wireless TELEGRAPHY is commonly used, the latter being employed by all ships for signalling to other ships and to land stations. Daily time signals are transmitted to vessels by wireless telegraphy, and vessels becoming lost may obtain their bearings from land stations by wireless. An "S.O.S." sent by wireless is almost certain to bring help from other ships.

SIGNATURE, in music, a group of sharps or flats placed after the clef to indicate the raising or lowering of notes throughout a composition which correspond with the lines or spaces so modified at the beginning. The signature of a composition is usually limited to the sharps and flats governing its KEY, but the metrical symbols, or time-signature, may be also implied. See also NOTATION.

SIGN-LANGUAGE, the use of signs and gestures as a medium of communication in lack of a common speech between tribes and nations, as well as among deaf-mutes. Originating in sheer necessity and practiced mostly in primitive stages of civilization, it is as old as mankind, and is universally employed even by the most advanced for illustration or emphasis, though it lags considerably behind any spoken language since it is not adaptable to generalizations or abstractions. Its most perfected form is that of the American Indians, expressed, like all sign-languages, by arm, hand, or finger, with or without facial gestures, the idea of "bird," for example, being denoted by lifting the hands to the shoulders, and moving them up and down to indicate wings, or "silence" by placing the tips of the fingers of one's right hand over one's lips.

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SIGSBEE, CHARLES DWIGHT (1845-1923), American navy officer, was born in Albany, N.Y., Jan. 16, 1845. He graduated in 1863 at Annapolis, and served in the latter part of the Civil War. He became interested in deep sea work for the Navy Department and in 1893-97 was chief hydrographer. In the latter year, after successive promotions, he was made captain of the *Maine*, which was blown up in the harbor of Havana during the night of Feb. 15, 1898, with great loss of life. The incident precipitated the Spanish-American War, and Sigsbee was placed

in command of the cruiser *St. Paul*, a transformed merchant vessel, and continued in the West Indies service for the rest of the war, being made rear-admiral in 1903. Sigsbee died in New York City, July 19, 1923.

SIGUENZA Y GONGORA, CARLOS DE (1645-1700), Mexican Jesuit poet, philosopher, mathematician and historian. Though a writer of some versatility, he is mainly important as a historian. His fame was such that he was named royal geographer by Charles II of Spain, and was invited to Paris by Louis XIV, but declined. His principal historical works are *Historia de la Provincia de Tejas*; *Anotaciones criticas a las obras de Bernal Diaz del Castillo y Torquemada*; *Genealogia de los reyes mejicanos*; *Historia del imperio de los Chichimecas*; and *Calendario de los meses y fiestas de los Mejicanos*. He also established *El Mercurio Volante*, the first review published in Mexico.

SIGUNA. See SIGYN.

SIGURD or **SIEGFRIED**, in Teutonic mythology, the hero who slew the giant Fafnir, and who woke BRUNHILD from her enchanted sleep, but being given a magic potion forgot her and married Gudrun, or Kriemhild, as she is generally called. Brunhild married Gunnar, the brother of Gudrun, but, angered at Sigurd's desertion of her, was instrumental in his murder.

SIGYN or **SIGUNA**, in Scandinavian mythology, wife of Loki, god of evil. When the gods punished Loki for the death of BALDER, by tying him in a cave where a serpent constantly spit upon him, Sigyn caught the poisonous spittle in a cup; but when it was full and she had to empty it, the deadly drops fell on his face and caused him terrible agony.

SIKES, BILL. See BILL SIKES.

SIKESTON, a city in Scott Co., southeastern Missouri, situated 180 mi. south of St. Louis. Bus lines and two railroads serve the city. The Boyer airport is 1 mi. north. Sikeston is in a rich agricultural district, producing corn, small grain, cotton, soy beans and various other crops. Flour and shoes are the chief local manufactures. The city was founded in 1864; incorporated in 1874. Pop. 1920, 3,613; 1930, 5,676.

SIKHS, members of a northwestern Indian community, followers of a line of 10 Gurus, or "teachers," of whom Nanak (1469-1539) was the first; worshippers of God under the title Sat Nam, "True Name." The word *sikh* means "disciple." The Sikhs to-day represent many sects. In general, however, there are two main bodies: (1) the Sahajdars, "easy-going" Sikhs, who adhere quite closely to the tradition of Nanak and yet are often distinguished with difficulty from their Hindu neighbors, and (2) the Keshdars (*kesh* means "hair"), who are ever distinct and who follow Nanak by way of the *tenth* and last Guru, Govind Singh (d. 1708). Nanak was not original; he accepted the Hindu doctrines of *karma* and transmigration; but he emphasized a faith of inner light, truth and understanding, rather than of

outward forms; He was indifferent to the many names of God, or to the class names of men; in harmony with influential reformers immediately before him, he taught the brotherhood of man and the sole reality of God. He left a Scripture known as the Japji, "honorable mention" (of Sat Nam, that is). With this various writings of later Gurus and others are combined into the Granth Sahib, or "Master Volume" of the Sikhs.

The Sikhs number about 3,250,000, 90% of whom live in the Panjab. Their headquarters are at Amritsar where their Golden Temple stands, among whose treasures is the venerated Book (Granth Sahib). They are agricultural, mercantile, and military. They have constituted a most important community in Indian affairs. Under Guru Govind Singh, and owing to pressure from both Hindu and Moslem leaders, the Sikhs were organized into the Khalsa ("pure"); they became a nation warring for their welfare, and growing strong by conquest. Their political zenith was attained under Ranjit Singh (d. 1839) and before 1850 they fought and lost in strenuous battle with the English. They surrendered their political prestige, but maintained their social solidarity and religious consciousness, and they have been the friends of England in times of British need. Their affairs are ground for sober consideration in the making of New India. J. C. A.

SI KIANG, or *West River*, the third largest river of China. The river rises in the northeastern part of Yunnan Province, flows in a general south-easterly direction across Kwangsi Province, enters Kwangtung Province at Wuchow, 900 mi. from its source, and, near its end, turns south to empty through a series of mouths in the general Canton-Macao area, one of these mouths being the Canton River. The total length of the Si Kiang is approximately 1,120 mi., as compared with 1,750 mi. for the Danube and 800 mi. for the Rhine. The upper portions of the Si Kiang are given various names by the Chinese. The river has a number of important tributaries, reaching into virtually the whole of four provinces and parts of another, and into Tongking. Vessels drawing as much as 5 ft. can reach Wuchow, 200 mi. from the mouth, even during the dry season. Small vessels of shallow draft can go up another 350 mi.

The Si Kiang basin includes an area of roughly 390,000 sq. mi., with a population of 60,000,000. The number per sq. mi. is relatively small, for China. This is due partly to the fact that a large portion of the basin is mountainous. More than a third of the population is found in the delta region in Kwangtung Province, less than one-fourth of the area. Another cause for the relative scarcity of population is the constant migration of people from this region into neighboring countries. For centuries the Si Kiang-basin Chinese have been the most actively adventurous of all the inhabitants of China, owing, perhaps, to the fact that the coast line of this region is, comparatively speaking, considerably longer than that of either the HUANG HO or the YANGTZE KIANG basins.

SIKKIM, a protected state in northeast India, bordering on Tibet, Nepal and Bhutan; area 2,818 sq. mi. Physically, Sikkim forms an eastern continuation of Nepal, from which it is separated by a lofty ridge of the Himalayas. Until recently the state owed allegiance to both Tibet and India, the maharaja accepting allowances from both countries, but the treaty of 1890 gave Britain exclusive control over its internal and foreign affairs. The inhabitants of Sikkim are mostly Rongs or Lepehas. Pop. 1921, 81,721.

SILAGE, or ensilage, for animal feeding. *See* ROUGHAGES.

SILAGE CUTTERS, machines to cut and convey corn fodder to storage. A common type has the knives and fan blades attached to a flywheel which operates at right angles to the feed table. Length of cut is varied by changing the speed of the feed apron, the flywheel speed remaining constant. Cutting of silage gains greater economy of space and permits the material to be so compacted as to exclude all air, thus preventing spoilage. *See also* CUTTERS, AGRICULTURAL. N. R. B.

BIBLIOGRAPHY.—H. P. Smith, *Farm Machinery and Equipment*.

SILAS LAPHAM, THE RISE OF, a realistic novel by WILLIAM DEAN HOWELLS; published 1885. Because his daughter Penelope is in love with a young aristocrat, Tom Corey, the aggressive Silas Lapham endeavors painfully to scale the social ladder of Boston. Representing the "American business man," he is comic and frequently offensive as a figure in high society. But Silas reveals his true fiber when, after being financially ruined, he "rises" through a succession of worldly and moral adversities.

SILAS MARNER, the shortest but perhaps the finest novel by GEORGE ELIOT; published 1861. Silas Marner, the weaver of Raveloe, lives alone in a little hut, embittered against all mankind because of the past treachery of his best friend. The poor creature is held in superstitious fear by all the villagers except Dolly Winthrop and her young son Aaron. He finds his only joy in the money which can be saved and hoarded, yet even this is taken from him when an unknown thief one night robs him of his gold. But gradually his bitterness against the world is sweetened by his tender love for Eppie, a child whom Silas finds under strange circumstances and later adopts; through her he finds his former self. Eppie, in reality the daughter of Godfrey Cass, the Squire's son, and a maidservant by a secret marriage, grows to womanhood and marries Aaron Winthrop, though she nobly refuses to leave Silas alone. At the last the bones of the thief who robbed Silas of his treasure are found in a deserted stone quarry, together with the stolen money. The thief was Dunstan Cass, the Squire's younger son.

SILENUS or **SELENOS**, in classical mythology, one of the Sileni, wood deities and companions of Dionysus (*see* BACCHUS). They were the old satyrs. As an individual Silenus is son of HERMES or PAN,

and is represented as a short, stout old man with full beard, carrying a wine skin. He was noted for prophecy and song.

SILESIA (Czech *Slezsko*), until 1927 a province of Czechoslovakia; since then united to the province of MORAVIA. It is a mountainous region of 1,708 sq. mi., sloping to the north and northeast. The southeast is favorable for agriculture which in general suffers from the rigorous temperatures. Rye, barley and potatoes are the chief products. Stock raising is also carried on. The mines supply excellent mineral coal. Industry is important and diversified, the foremost branches being textiles, iron, machinery, chemicals, oil refining and beet-sugar. Of the inhabitants approximately one half are Czechs, and the remainder Germans and Poles. A large per cent are Catholics, with a few Protestants, a very small percentage of Jews and some members of the Czechoslovak National Church. Pop. 1930, Moravia and Silesia, 3,563,157. See CZECHOSLOVAKIA, HISTORY OF.

SILESIAN WARS. See AUSTRIA, HISTORY OF.

SILETZ, the southernmost tribe of the North American Indian Salishan linguistic stock, a subgroup of the Tillamook. Formerly they lived on the Siletz River in northwestern Oregon. In the present century the name has included all the tribes living on the Siletz Reservation in Oregon, belonging to the Athapaskan, Yakonan, Kusan, Takelma, Shasta and Shahaptian linguistic stocks.

SILHOUETTE, a profile portrait, usually in opaque black, simulating the sitter's shadow. Such inexpensive likenesses were popular in 18th century France and England, and later in America. They were named in contempt after Étienne de Silhouette, discredited finance minister to Louis XV. Silhouettes were cut from black paper, or "hollow-cut" from white and mounted on black, or painted on plaster, ivory or glass. Miniature "jewel-shadows" were set in rings, brooches or pendants. The art fell into disrepute in the early Victorian period.

In America, Bache, William Brown, and the Frenchman, Edouart, were notable exponents of this minor art.

SILICA, a common name for silicon dioxide (SiO_2), a mineral widely distributed as quartz or rock

crystal. It occurs in forms of lesser purity, as jasper, agate, chalcedony, petrified wood, etc. Transparent fused silica looks like glass, but its high melting point (1700°C.), transparency to ultra-violet radiation and low thermal expansion, fit it for such uses as tubes for mercury vapor lamps, optical parts of spectrographs and chemical apparatus. Silica, as glass sand, is the basic raw material of the glass industry and the art of vitreous enameling. Alone and in combination, silica constitutes about 60% of the earth's crust. See SILICATES.

J. G. V.

BIBLIOGRAPHY.—Sosman, *The Properties of Silica*, 1927.

SILICA GEL, a solid consisting of amorphous silica and possessing an exceedingly fine capillary structure. It is produced by causing a colloidal solution of silica acid to coagulate, to form a hydrogel, washing the latter free of salts and acids, and then drying to remove most of the water. The colloidal solution of silicic acid is usually obtained by treating sodium silicate (water glass) solutions with proper amounts of acid.

Silica gel is a powerful adsorbent of gases (see ADSORPTION), vapors and dissolved substances. It owes its adsorbing properties entirely to its fine capillary structure (see CAPILLARY PHENOMENON). Furthermore, due to its inertness as regards chemical change, it may be easily reactivated by heating in air, and also be safely employed in dealing with chemical substances of high activity.

The first practical development of silica gel occurred in the Chemical Warfare Service during the World War, in connection with the use of this material in gas masks (see CARBON, ACTIVATED). The success of this adsorbent in gas masks quickly suggested its use in chemical and engineering problems. Among the industrial applications of the material may be mentioned the removal of moisture from air; the recovery of gases and vapors; the purification and drying of carbon dioxide; the refining and purification of non-aqueous liquids, such as petroleum products, benzene, etc.; as a means of producing refrigeration, and as a supporting material of catalysts.

As a means of producing REFRIGERATION, it operates so as to condense the vapors of the refrigerant thus causing the latter to continue to evaporate. The refrigerant is removed from the saturated gel by heat and returned to the evaporate through a condenser, whereupon the cycle is repeated. It is thus apparent that the adsorbing gel replaces the compressor in the mechanically operated refrigeration machine.

Silica gel owes its effectiveness to its ability to condense as liquids in its ultra-microscopic capillaries, the gases, vapors, and dissolved matter which it adsorbs. In addition to the ease of condensation of the substance to be adsorbed there must always be taken into consideration the question of wetting or spreading of the adsorbable material. For example, silica gel is not a suitable adsorbent for use with aqueous solutions, due to the fact that it is wetted by water in preference to all other substances. For the same reason it is the most powerful adsorbent for use with such



SILHOUETTE OF JOHN RANDOLPH OF ROANOKE

liquids as petroleum products due to the fact that such substances do not wet silica gel. W. A. P.

SILICATES, combinations of silica and one or a plurality of bases which constitute hundreds of silicate mineral species which are the principal constituents of the earth's crust. Most of the metals form silicates which, with the exception of the alkali group, are insoluble in water. Many of them, however, undergo slow decomposition under the influence of water and carbon dioxide, as when feldspar, a potassium-aluminum silicate, is weathered to yield clay, a hydrous aluminum silicate. The silicate group includes such familiar minerals as asbestos, mica, talc, beryl, emerald, topaz, garnet, tourmaline and such rock masses as granite, basalt, gneiss, obsidian, slate, shales, schists, etc.

Industrially, the natural silicates form the most enduring of structural materials. Clays, of which there are many, are the basis of the ceramic industry, earthen vessels having been among the first products of human manufacture. The most advanced modern technic of silicate chemistry is to-day employed in art and industrial porcelains, glazed clay wares and enamels upon metals, all of which depend upon the formation of appropriate silicates. The making of glass consists in preparing silicates of soda, potash, lime, lead or other metals in such proportions as to yield transparent vitreous bodies of exactly predetermined characteristics and cooling them under such conditions that the separate crystalline silicates do not appear. **PORTLAND CEMENT** is an artificial silicate combination characterized by the ability to combine with water and set. The art of concentrating minerals from their ores consists, in most cases, in separating silicate minerals which constitute the bulk of the ores, from sulphide and oxide minerals which contain the values.

The silicates of the alkali metals are soluble. Sodium and potassium silicates are industrially important, being the only cheap materials of mineral origin which have glue-like characteristics. Some soluble silicates are available in crystalline form, useful for cleaning solutions where the combination of active alkalinity with non-corrosive properties is desirable. See **WATER-GLASS**. J. G. V.

BIBLIOGRAPHY.—Frank W. Clarke, *The Data of Geochemistry*, United States Geological Survey, fifth edition, Bulletin 770, 1924; James G. Vail, *Soluble Silicates in Industry*, American Chemical Society Monograph 46, Chemical Catalog Company, Inc., 1928.

SILICON, a non-metallic chemical element, which, although never occurring in the free state, is one of the most abundant constituents of the earth's crust. Its chemical symbol is Si, the atomic weight 28.06. The oxide, often called **SILICA** or quartz, and its combinations with metallic oxides known as **SILICATES**, are the basis of sand and nearly all rocks. The combination with carbon, known as carborundum is of exceedingly great hardness, and used as an **ABRASIVE**. Silicon steel, containing about 3% of the element possesses properties superior to those of iron for magnetising purposes.

SILICON CARBIDE, best known as **CARBORUNDUM**, is an abrasive material made by heating ground

coke and sand in an electric furnace at about 1950° C. The furnace is built up with each charge, only the bed and the end walls which hold the electrodes being permanent. A core of coke is formed between the electrodes, and the mixed charge of coke and sand, possibly with sawdust for porosity and salt as a flux, is built up around this core. When the reaction is complete the charge is dug out; the silicon carbide, which appears in the form of blue or greenish-gray to yellow crystals, is separated from the unreacted materials, crushed, washed with weak acid, and screened to various sizes.

Silicon carbide has a specific gravity of 3.2 and a hardness of 9.5—nearly as hard as diamond. Its principal use is as an abrasive, either as a powder or formed into wheels and stones. It is also used as a refractory material and for electrical resistances.

C. H. P.

SILICON IRON. High silicon iron is cast iron containing 12-16% silicon; chemically, a silicide of iron dissolved in iron. Analysis of a typical product, such as duriron, shows silicon 14.50%, manganese .65%, carbon .85%, traces of sulphur and phosphorous, balance iron. Melting point 2300° F., scleroscope hardness 50, coefficient of expansion per degree F. .0000156, tensile strength ultimate 15000 lbs. per sq. in., specific gravity 7. It is not subject to oxidation and is chemically resistant to practically all acids and corrosive solutions, hence is commonly known as acid proof iron.

High silicon iron is used extensively in chemical and other process industries in the form of pumps, valves, pipe fittings, concentrator and condenser parts, exhaust fans and special mechanical equipment for handling corrosive solutions and gases that destroy ordinary materials of construction. It can be cast in all ordinary shapes and sizes, but special designs are required, owing to the high coefficient of expansion. Practically all machining is done with grinding wheels. W. H. S.

BIBLIOGRAPHY.—M. A. Corson, *The Constitution of the Iron-Silicon Alloys*, technical publication No. 96, American Institute of Mining & Metallurgical Engineers, New York, 1928.

SILICON STEELS, steels containing silicon, which are melted in open-hearth or electric furnaces. Silico-manganese steel is used for gears and springs in low priced automobiles. It requires careful heat treatment to avoid brittleness. Quench from about 1575° F. in oil; temper to suit applications. Average analysis in per cent: carbon 0.60, manganese 0.7, silicon 2.00.

Magnetic silicon steels as low as possible in carbon and other non-ferrous elements, possess low hysteresis and high permeability. They are used in sheet form in alternating current generators, induction motors, and transformers. Average analysis in per cent: 0.75, 2.5, 3.25 and 3.75 silicon. C. M. J.

SILIUS ITALICUS (c. 25-101 A.D.), Roman epic poet, whose full name was Titus Catius Silius Italicus, was born about 25 A.D., probably of Spanish origin. Prominent in the law and in public offices, he was a

consul in 68 and later a proconsul in Asia. He was a patron of art and literature, and is said to have owned estates that had been the property of CICERO and VERGIL, whom he strove to imitate in style. *Punica*, his best known work, was discovered in the 15th century. The poet is also credited with the authorship of a latinized *Iliad*. In 101, having an incurable disease, Silius Italicus starved himself to death in the manner of a true Stoic.

SILK, as usually understood, is a fiber forming the cocoon of the silk moth (*Bombyx mori*) of which there are several varieties.

Records show that since 3000 B.C., silk has been woven for fabrics, starting in China, where it had an almost sacred place in the social life, spreading to Japan in 3rd century B.C., to India and Persia some 600 years later, reaching Rome in 551 A.D., when two Persian monks brought the Emperor Justinian some silk moth eggs hidden in their bamboo staffs.

The caterpillar of the silk moth spins around itself a cocoon composed of a single thread from 500 to 1,000 meters long. Inside this it changes to a chrysalis, then to a moth which eats its way out, mates and dies when the female has laid 300 to 500 eggs (seed) of which 10% are infertile. The raising of silk is of great importance to Japan, China, India, Persia, Syria, Greece, Italy and France. Many attempts to breed silk moths in America have failed though there are promising experiments in several countries.

The three chief varieties are the Chinese, Japanese and European; some hatch out once in the season (univoltine), some twice (duo or bivoltine), others three or more times (polyvoltine). The best quality silk comes from the univoltine sorts; it is hatched in spring, but by artificial means a second hatching can be produced.

The seed (eggs) are laid on cards, 28 moths to a card. To prevent hatching until required, the seed cards are kept in cold storage; in some parts of Japan in natural ice caverns. In this way, a regular supply of worms is kept up through the season. Seed is subject to rigorous government inspection in Japan.

Newly hatched caterpillars are small, hairy and black; these "ants" are fed chopped mulberry leaves of which they eat three times their own weight in the first 24 hours, a very critical period. There are four changes of skin during the month of active feeding, the worm resting until the old skin cracks revealing the new one, the last being creamy white. When fully grown, three to three and a half ins. long, it ceases feeding and searches for a place to spin the cocoon; this is supplied as twigs or twisted straw. Girls care for silkworms, keeping them supplied with fresh mulberry leaves (there are 1,500,000 acres of the trees in Japan alone) and constantly cleaning them out. If not kept clean and disinfected, the worms would suffer from pebrine, grasserie, flacherie, muscardine and other diseases.

When ready to spin, the silk glands which are long sacs running down the sides of the caterpillar

and opening at the spinneret just by the under lip, are filled with liquid silk. At this stage some are taken for making SILKGUT for fishing lines. The silk thread, which is mainly white or yellow, is extruded from the spinneret as two separate fibers (baves) glued together with silk gum (sericine) from glands suitably placed. The cocoon is one to one and a half ins. long and weighs 20 to 30 to the oz., fresh; it may be oval or kidney shaped, the former having more silk. Breeds of worms are crossed to produce desired qualities of silk. The pupa is stifled in the cocoon before it emerges and spins the silk, some being saved for breeding; the dead cocoons are dried and sent to the filatures where girls place them in china basins of boiling water to soften the gum and then reel off the fiber from three to eight, up to 24 cocoons to form a thread of the required thickness. "Reeling" is very highly skilled work; for the American market the silk is rereeled to produce perfect hanks with a diamond cross; 30 hanks pack to form a "book"; 15 or 16 books, weighing 70 to 90 lbs., make a case for the export dealers. These classify the silk under government supervision, repacking in bales of 28 books weighing 133½ lbs. Japanese or 106½ lbs. Canton; the unit for export trading is 10 bales = 1 lot. See also SILK MANUFACTURE.

F. G. P.

Silk Trade. The world's supply of natural raw silk as based on exports from the various silk producing countries totals about 85,000,000 pounds annually. This figure is much too small because China and Japan, which produce about 85% of the world's supply of silk, consume about 55% and 30%, respectively, of their output at home. Therefore, the production is probably in the neighborhood of 125,000,000 lbs. In western Europe about 10,000,000 lbs. of silk are produced annually, Italy contributing more than 9,000,000 lbs., France about 500,000 and Spain the remainder. In eastern Europe, the Levant and central Asia almost 2,000,000 lbs. are produced. China exports more than 10,000,000 lbs. from Shanghai and some 6,000,000 from Canton, while Japan ships 50,000,000 lbs. from Yokahama. About 120,000 lbs. are exported by British India from Bengal and Cashmere, and Indo-China ships about 84,000 lbs. from her ports. During the past two decades the consumption of silk has been increased by almost 60% with the proportion taken by the United States increasing from 40 to more than 60%. The proportion taken by Japan has increased from about 7 to 10%, while the percentage consumption of the other countries has decreased. Europe takes only 21% as compared to 40% previously consumed. This change has been effected by the rapid adoption of power looms in the United States and to a lesser extent in Japan.

SILK, ARTIFICIAL. See CUPRAMMONTUM SILK.

SILKCOTTON TREE, a huge tree (*Ceiba pentandra*) of the bombax family, native to the West Indies and widely cultivated in all tropical lands for ornament or use. The leaves are deciduous; young plants are thorny; in older trees the massive trunk

frequently develops flattened buttress roots sometimes 10 ft. in height and 15 ft. in radial width. The showy flowers appear on leafless branches and are followed by large capsules containing seeds surrounded by a mass of brown silky fibers. The fibers are too weak to be of value in spinning but are used extensively under the name kapok for filling mattresses and cushions and are especially valuable in life-preservers. Java now furnishes most of the commercial kapok, which has become an important article of trade.

SILKGUT, a very fine, tough gut used for fastening hooks to fishing lines. The best qualities are made from silkworms (*see* SILK) which are taken when about to spin their cocoons and are killed by soaking for some hours in strong acetic acid. The silk glands are removed, and stretched between pins on a board to dry and harden in the sun. Many anglers prefer the gut made in Spain, the "selecto" grade being the best; this is very tough, having a breaking strain under sudden pull of from 17 to 23 tons per sq. in.

SILK MANUFACTURE. The silk manufacturer receiving the raw silk (grege) first soaks it in soap and oil to soften the hardened spots of silk gum (gumtacks); he then winds the silk from the skeins on to bobbins and "throws" (twists) several together to form yarns for warps (organzine), filling (tram) and crepes. Care is taken to keep the air of the rooms, where these complicated machines are, sufficiently humid to prevent generation of static electricity while winding the silk on to bobbins and pirns.

Waste silk, including floss from cocoons, dupions (double cocoons), remainders from the processes, is sorted and treated much like wool by washing, combing, drawing and spinning to form spun silk or schappe, which is much used for fabrics.

Silk weaving (*see* WEAVING) is an important industry; of around 400,000 power looms in the world, the United States owns over 40%. Except in China the few handlooms are reserved for very expensive fabrics, and for millers' gauzes; these latter are made exclusively in Switzerland. The first stage in weaving is preparing the warp; organzine yarn is wound from many bobbins on to the warping beam. After sizing to protect the silk from frictional wear, a definite number of threads (ends) are drawn through the heddles and distributed through the reed of the loom by means of which the correct threads are lifted up for the passage of the shuttle containing the filling or weft yarn.

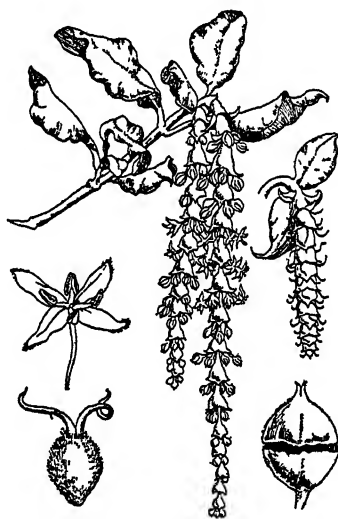
Much silk is weighted (*see* WEIGHTING) by a deposit of tin-phospho-silicate to give it a firmer handle. Before DYEING, the gum is removed by boiling with soap, the resulting liquor being used in the dye-house. The softened silk is dyed with great care owing to its delicacy and high price.

The world's annual output of grege is about 58,000,000 kg. of which Japan supplies over 60%; about the same quantity is imported to the United States,

valued at \$400,000,000. The value of fabrics imported is about \$18,000,000 and exported \$15,000,000. F. G. P.

SILK OAK, a numerous genus (*Grevillea*) of trees and shrubs of the protea family. There are about 200 species native chiefly to Australia, several of which are planted in warm regions as ornamental and timber trees. In size and aspect they range from handsome lofty trees to humble reclining shrubs. The best known silk oak (*G. robusta*), a rapidly growing tree sometimes 150 ft. high, is planted in California and Florida as a street and lawn tree. It bears handsome clusters of golden-yellow flowers which attract bees and honey-loving birds. In cold climates it is one of the most highly prized of the fern-leaved pot plants.

SILK-TASSEL TREE, a genus (*Garrya*) of small trees and shrubs of the silk-tassel family, so named on account of the long, pendulous, silky flower-clus-



SILK-TASSEL TREE
Staminate branchlet, staminate flower and
pistillate flower (left) and pistillate catkin
and capsule (right)

ters. There are about 18 species found in western North America, Mexico and the West Indies. Of the seven species native to the United States the best known are the silk-tassel tree (*Garrya elliptica*), called also QUININE BUSH, and the bear brush (*G. Fremontii*), both found in the chaparral belt of California mountains.

SILKWORM, a species of moth (*Bombyx mori*) of the family *Bombycidae*. In a broader sense, the term may be applied to any moth of this family. It may also be used to designate members of the family *Saturniidae*, or giant silk-worms. *Bombyx mori* is truly a domesticated insect. A native of Asia, it has been reared commercially in many parts of the world. Larvæ feed preferably upon white and black mulberry, but will eat osage orange. Newly hatched larvæ are dark gray or black when hatched and will

eat lettuce leaves. Mature caterpillars are creamy white in color. Cocoons are whitish or yellowish in color, and each is spun of one continuous thread. For this reason the silk may be unreeled and used commercially. To obtain the silk, the pupa within the cocoon must be killed. Only a few moths are allowed to emerge. These, when mated, lay eggs to produce the next generation. J. R. T.

SILL, EDWARD ROWLAND (1841-87), American poet and essayist, was born in Windsor, Conn., Apr. 29, 1841. He was graduated from Yale University in 1861, and later studied divinity at Harvard University. He abandoned the ministry, however, and became literary critic for the New York *Evening Mail*. From 1871 to 1882 he was in California as principal of the Oakland High School and later as professor of English at the University of California. In 1900 his *Prose* was published, and six years later *The Poetical Works of Edward Rowland Sill*. He died in Cleveland, O., Feb. 27, 1887.

SILL, a flat, tabular, extended mass of IGNEOUS Rock, lying more or less horizontally, particularly between the planes of stratification of SEDIMENTARY Rocks. It is called also an intrusive sheet, because intruded into the enclosing rocks while still a molten MAGMA. If the intrusive sheet cuts across the STRATA and approaches a more nearly vertical attitude, it becomes a DIKE.

SILLIMAN, BENJAMIN (1779-1864), American chemist and geologist, was born at Trumbull, Conn., Aug. 8, 1779. He was graduated from Yale in 1796, and became professor of chemistry and mineralogy there in 1802, retaining that position for 51 years. He was a popular scientific lecturer, and founded the *American Journal of Science and Arts*, of which he was sole editor from 1818-38. He published *Elements of Chemistry, Travels in England*, and edited Henry's *Chemistry*, and Bakewell's *Introduction to Geology*. Silliman died at New Haven, Conn., Nov. 24, 1864.

SILLIMANITE, a highly refractory mineral with the same composition as ANDALUSITE and kyanite (or cyanite), but more stable. It is usually brown, gray, or green, transparent to translucent, with a glassy appearance. Sillimanite is usually found in granites and gneisses, but not in workable quantities. It is an aluminium silicate, crystallizing in the ORTHORHOMBIC SYSTEM. The artificial mineral is used to make spark plugs and refractory bricks. It is found especially in Germany, France, India, New York and Pennsylvania. See also MINERALOGY.

SILOS, towers, pits or trenches in which green forage crops, such as corn, peas, rye, sunflowers and clover, are cut and packed airtight to undergo fermentation. Proper fermentation takes place only in absence of air with the formation of lactic and acetic acid and some carbon dioxide. Silage thus formed insures animals a succulent feed the year round. The first silos were merely pits filled with uncut fodder; concrete lined pits are still used, while the most recent type of silo is a trench in well-drained soil.

Above ground silos are circular tanks of wood, masonry or metal.

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SILT, the fine product of the decomposition and disintegration of rocks, under the influence of WEATHERING and EROSION. Silt is often considered to embrace the material intermediate in size between SAND and CLAY, and, like clay, to be composed largely of kaolin, though such minerals as mica, quartz and feldspar may occur.

SILURIAN PERIOD, the third period in the PALEOZOIC ERA of geological history. Trilobites, which dominated the preceding Ordovician period, decline, and the cephalopods and eurypterids rule the seas.

SILVA, ANTONIO JOSÉ DA (1705-39), Portuguese dramatist, was born at Rio de Janeiro, May 8, 1705. He was about to begin legal practise when he was brought before the Inquisition. Acquitted, in 1737, he was again summoned before the tribunal, and after two years' imprisonment was condemned to be burnt at the stake at Lisbon, Oct. 19, 1739. His operas based on mythology are, according to Portuguese ideas, humorous in the extreme.

SILVA XAVIER, JOAQUIM JOSÉ DA, called also Tiradentes (1746-92), Brazilian liberator, born on Nov. 12, 1746, in São João del Rey. His father was a fairly prosperous planter of Minas Geraes, but at 11 the boy lost both his parents. He received a good education and became a traveling salesman and an excellent dentist; later entering the military service. Tiradentes is known for his part in the so-called *Inconfidência Mineira*, a conspiracy of young poets and philosophers in 1789 against Portugal and aiming at the establishment of a republic in Brazil. The authorities, advised of the conspiracy, arrested the leaders. Tiradentes alone of them all was executed and quartered Apr. 21, 1792. He is revered in Brazil as the proto-martyr of independence.

SILVER, an element designated chemically by the symbol Ag, from *argentum*, has the atomic number 47 and the atomic weight 107.88. It is notable for its ductility, malleability, luster, high electrical conductivity, and its resistance to oxidation.

Silver occurs native and in the form of sulphide ARGENTITE, and the chloride, CERARGYRITE, or horn silver, and a number of other compounds. It is often associated with LEAD and COPPER and is recovered as a by-product in the refining of those metals.

Silver is, properly speaking, monovalent, although it forms "complexes" such as $\text{Ag}(\text{NH}_3)_2\text{Cl}$. It is attacked by NITRIC ACID and by hot, concentrated SULPHURIC ACID, but not by dilute sulphuric or by HYDROCHLORIC ACIDS. It is unaffected by atmospheric oxygen but is attacked and stained by SULPHUR and many sulphur compounds.

The nitrate, AgNO_3 , is known as "lunar caustic" and is used as a caustic and disinfectant. It is sometimes employed as an ingredient in indelible inks intended for marking textiles. In the presence of

light the nitrate is reduced by the organic matter of the textile, leaving a deposit of black metallic silver.

The halides of silver are remarkably susceptible to the action of light and have made possible the development of modern photography. The bromide finds the greatest use in this field. The motion picture industry and the mint are said to be the greatest consumers of silver in the United States. O. R.

SILVERBERRY (*Elæagnus commutata*), a shrub or small tree of the oleaster family, so called because of its silvery, edible, drupe-like fruit. It grows on banks and hillsides from Quebec to Utah and British Columbia northward to Hudson Bay and Yukon. It is a much branched plant, 6 to 15 ft. high, with brownish scurfy twigs, oval leaves, densely silvery on both sides, and numerous fragrant flowers, silvery without and yellowish within.

SILVER FERN (*Pityrogramma calomelanos*), a beautiful greenhouse fern native to tropical America, widely grown for its large handsome fronds, covered with silvery white powder beneath and borne on shining black stalks. A variety (*aureo-flava*) with gold-colored powder beneath is known as **GOLD FERN**.

SILVER GRAYS, the conservative element of the WHIG PARTY, which came into power when MILLARD FILLMORE, elected to the vice-presidency in 1848, became president upon the death of ZACHARY TAYLOR. The group was led by Fillmore, R. C. Winthrop and Rufus Choate. When the Whig party declined most Silver Grays became Democrats.

SILVERIUS, ST., Pope from 536 to 537, was the son of the Pope Hormisdas, who had been married before his election. He owed his elevation to the papal throne to the Gothic King Theodat. As an opponent of the Byzantine ecclesiastical policy, he was exiled after the capture of Rome by Belisar, first to Patara in Lycia and later to the island of Palmaria.

SILVER PARTY, a defection from the ranks of the Republican party, 1896, on the currency issue. The Silver Republicans held an independent convention endorsing Bryan and Sewall, the Democratic nominees for president and vice-president, who favored the free coinage of silver.

SILVER PLATE, domestic and ecclesiastical utensils made of silver. Since the beginning of the 14th century each piece of silver plate has borne a mark peculiar to the silversmith who made it. Of domestic plate the earliest coffeepots date from 1670; the earliest teapots from 1717; creamers, milk pitchers and sugar bowls were added later. Four-pronged forks were first made in 1682. Spoons date from Greco-Roman times. Many European cathedrals have famous collections of silver candlesticks, censers, incense boats, bells, crosses, chalices, alms dishes and ablution bowls which have come down from the Middle Ages, as well as profane articles, such as flagons and tankards, which have been willed to them.

The process of producing Sheffield Plate was discovered in 1742 by Thomas Boulsover of Sheffield,

England. The process consisted of welding a layer of silver to a copper foundation by heat and pressure.

Elaborate Repoussé work, engraving, chasing and enameling are characteristic of silver plate.

SILVERSIDE, the name for a numerous family (*Atherinidae*) of small, spiny-rayed, mullet-like fishes found along sea coasts and also in fresh waters in warm climates. They have long, more or less compressed bodies, two distinct, well-separated back fins, and usually a prominent silver stripe on each side. Where abundant they serve as food for larger fishes; some species are used for human food. The common silverside (*Menidia menidia*), about 6 in. long, ranging in various forms from Florida to Cape Cod, is one of the most abundant of North American small fishes. It is much used for bait.

SILVERSMITHS' AND GOLDSMITHS' WORK. These allied arts which were regarded among the ancients as one industry are at the present day distinct.

Much of the gold jewelry found in Egyptian sarcophagi dates from 2000 B.C. To approximately the same date are attributed the great Priam Treasure unearthed by HEINRICH SCHLIEHMANN at Hissarlik, the modern Troy, and to an even earlier period much extant Minoan gold jewelry, death masks and weapons. Identical with the earliest specimens from Crete and Troy, c. 2500 B.C., are the archaic Greek types of 2000 years later. Almost entirely oriental in design, early Greek jewelry is largely of pure, beaten gold delicately ornamented with FILIGREE. Wire or filigree work reached its height in the 3rd century B.C. A fine example of 5th century silver work is the flower-type cup in the Metropolitan Museum of New York. Etruscan and Roman metal work derive from the Greek. In Rome the cult for silver plate produced such fine specimens as those in the Hildesheim Collection in the South Kensington Museum in London.

Among examples of ancient Asiatic techniques are the Persian Oxus Treasure, dating from the 5th and 4th centuries B.C. and the Bimaran (India) gold reliquary, dating from the beginning of the Christian era. Both examples are in the British Museum in London. Ancient China, although poor in gold, produced some fine work as early as the Ch'in Dynasty, 255 to 207 B.C. In the Americas the high skill attained by Mexican and Peruvian artisans before the Spanish conquest is proved by the disc-shaped, golden breastplates which have been discovered in various parts of Central and South America.

With the decline of classic art at the close of the 3rd century A.D. that of Byzantium came to the front; the *pala d'oro* in St. Marks, Venice, 976, being typical of the eastern goldsmiths' art. Before the decline of Byzantine art in the 11th century Kentish and Irish metal workers in the British Isles, and the French workers of the Merovingian and Carolingian periods had begun to break away from eastern influences. By the 12th century the monasteries of Western Europe had developed a style of their own, which during the

11th and 12th centuries was characterized by a massive simplicity of design. In these centuries great quantities of chalices, altars, reliquaries and other ecclesiastical furnishings were produced. During the 13th and 14th centuries the precious-metal work of the Middle Ages reached its highest perfection, the 15th century marking a decline from which even the technically unsurpassed, florid high Renaissance art of Benvenuto Cellini, 1500-71, failed to redeem it.

Neoclassic simplicity, the result of the excavations at Pompeii and Herculaneum, was introduced into England by the brothers Adam, and from there found its way to the American Colonies. Here excellent native work flourished by the side of importations, 150 silversmiths being recorded in Boston before 1800. The style adopted by such Colonial smiths as Paul Revere was in keeping with the general good taste of the times. Like all the applied arts, gold- and silver-work reached a low watermark during the Victorian era, from which it is being revived to-day along severely simple, modernistic lines. *See also* SILVERWARE.

SILVER STANDARD. *See* BIMETALLISM; GOLD STANDARD.

SILVERWARE, articles made of silver, such as vases, ornaments, utensils and various kinds of tableware. The earliest known silverware is that which has been recovered from Etruscan tombs. The art of silver manufacturing passed from the Etruscans to the Romans, who came to use elaborate gold and silver services at their feasts. Many examples of these ancient services which have been unearthed are of such exquisite workmanship that modern art has no parallel.

After the decline of Rome, Venice took the ascendancy in the artistic world. Chief among early Italian silversmiths was **BENVENUTO CELLINI**, whose mastery of the craft is attested by the magnificent saltcellar designed by him for his patron, Francis I of France. In Germany in the 16th and 17th centuries the great centers for silverware manufacture were Nuremberg and Augsburg. Little remains of the work of French silversmiths of this time because of the consignment of the best of France's gold and silverware to the melting pot to raise revenue for the State.

Silverware began to occupy a prominent place in Great Britain during the 16th century. The formation of the Goldsmiths Company of London was an event of high significance to the silversmith. For three centuries this company controlled the silver trade of the civilized world. Since 1300 all English silverware has been required by law to bear the stamp of the maker. In America the manufacturing of silverware began in Philadelphia early in the 19th century. Paul Revere, of Revolutionary fame, was an admirable silversmith and examples of his work are to be found in American collections to-day.

Outstanding characteristics of 17th century silver are the rectilinear influence and sturdy proportions. This robust style is most clearly marked in the contour of spoons, tankards, mugs, beakers and candlesticks. Toward the middle of the century the style of decora-

tion prevalent in the William and Mary, the Queen Anne and the Early Georgian eras made its impression on silverware. This was seen particularly in the emphasis of curves. Items of silverware for table use had now become far more numerous and varied than ever before.

After 1760 the style of silverware underwent a complete change. There was a noticeable return to rectilinear principles and an attenuation of design. Emphasis was laid on straight lines, and the spontaneous rotundity of curved articles was suppressed as much as possible. Low, squat contours were replaced by tall and slender shapes. The handles of spoons were turned down instead of up, and their bowls tapered more and more at the smaller end. Salts were generally oval in form, and often approached in contour the spreading type of classic urn. Candlesticks had straight, unbroken vertical stocks, and were often wrought in the form of classic columns.

The Empire influence in silver design appeared at about the beginning of the 19th century, and was apparent in the fiddle-headed pattern so popular at this time. Forks and spoons, identical in pattern, had prominent shoulders on either side of the stem just above the tines or bowl, and a broad flat fiddle-shaped termination. In hollow ware, the slender lines previously in demand gave way to round or oblong contours, which often stood upon ball feet. While curves were again popular, they were not so exaggerated as in the early part of the 18th century.

Silver design in the 19th century suffered the same decline evidenced in other branches of decorative art. Tableware of this age is apt to be grotesque, overdecorated and nondescript. In the 20th century silver design has developed grace and distinction. American manufacturers have kept abreast of their French and English competitors, and in many instances have produced silverware outstanding in originality and charm.

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SIMBIRSK. *See* ULIANOVSK.

SIMCOE, LAKE, a picturesque sheet of water in the province of Ontario, Canada, between Lake Ontario and Georgian Bay. It drains into the latter through Severn River. Its dimensions are length, 30 mi.; width, 18 mi.; area, 271 sq. mi. The surface is studded with numerous islands, one of which, Snake Island, is inhabited by Indians. The surrounding country is still in a primitive state and noted for its beautiful scenery. Forests extend to the lake shores, which are a favorite summer camping ground.

SIMEON, in Biblical account the second son of Jacob by Leah, and the name of a tribe of Israel. The Genesis narrative associates the tribe of Simeon with the tribe of Levi as having suffered a common annihilation in the Canaanite conflicts centering around the city of Shechem in central Palestine. The city as well as the tribes is represented in the Bible. Whatever remnants of the tribe of Simeon were left were apparently absorbed by the tribe of Judah.

SIMEON BEN YOHAI (2nd century), one of the greatest Tannaim, or teachers of the Mishna, in Palestine in the period after the Hadrianic wars and the revolt of Bar Kochba, 135-150 A.D., was born in Galilee. Rabbi Akiba, the famous martyr of this revolt, was his teacher, and Rabbi Meir was his colleague. Simeon ben Yohai participated in the famous Synod of Usha in the year 136, after the Bar Kochba revolt was over. He was opposed to Rome and to its culture. On one occasion, in order to escape death at the hands of the Romans, because he had bitterly censured one of their officials and condemned Roman institutions, he was compelled to hide in a cave for some unknown length of time. After his return he taught at Meron. He was famous as an expounder of the Jewish Law. He is believed to have died at Meron, near Safed.

Simeon's reputed 13-year stay in the cave became, in later centuries, the subject of innumerable legendary amplifications and the basis for many Cabalistic tales. Indeed, for many years it was believed that while in hiding in this cave he wrote the *Zohar*, which became the text-book of the Cabalistic movement, and Simeon its hero. Many apocalyptic writings dealing with Messianic predictions were likewise ascribed to him. In actuality, however, Simeon ben Yohai was neither a mystic, nor a worker of miracles, but a practical and logical expounder of the Jewish Law, and a constructive and unsparing exponent of the defects, hypocrisies, immoralities and injustices of Roman rule. A. SH.

BIBLIOGRAPHY.—Louis Lewin, *Rabbi Simon ben Yochai*, 1893; Graetz, *History of the Jews*, 1926.

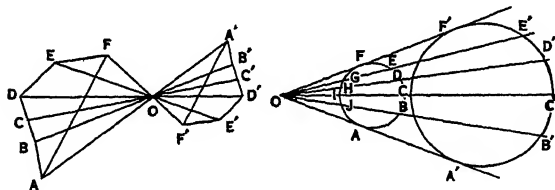
SIMEON STYLITES, ST. (390-459), Syrian hermit, was born in Syria about 390. Of humble parentage, he lived in a monastery to which he had retired at an early age, until his extreme ascetic practices caused his expulsion at the age of 30. He thereupon dwelt on the tops of pillars, changing from one to another until he found one which was satisfactory. He lived a life of prayer and meditation in this way for about 37 years, attracting huge crowds and converting many by his vehemence and spiritual fervor. His pillar was so narrow that although he could stand, kneel or sit, he could not lie down; food was contributed by disciples who brought it up to him by means of a ladder. This almost incredible account of his life is apparently well-authenticated by contemporary testimony, and gained for Simeon the epithet "pillar-saint," from the Greek *stulos*, pillar. His example was often copied, and pillar-hermits were quite common until comparatively recent centuries. Simeon died about 459 in Syria and his feast is celebrated on Jan. 5.

SIMFEROPOL, capital of the Crimean Autonomous Socialist Soviet Republic, which forms a part of the R.S.F.S.R., and the commercial and cultural headquarters of southern Crimea, situated on the steppes among the Chatyr-dagh Mountains. Large fruit-preserving factories there testify to Simferopol's significance as a fruit center; there is also heavy trading in

tobacco. The city is divided into three sections: the administrative quarters, the old Greco-Tatar section and the modern New Town. The site was settled by Greeks in antiquity; during medieval times the Tatars ruled, and about 1783 it was annexed to Russia. Under Russian control its name was changed from Ak-Metchet to its present title, signifying "city of different nationalities." The State University and the Central Tauric Museum are notable institutions. Pop. 1930, 96,300.

SIMIA, a city and district in the northern Punjab region, India. The city is the summer residence of the viceroy of India and his staff, hence, it is known as the summer capital, and the headquarters of the Punjab government. The site, in the foothills of the Himalayas, is one of great natural beauty and for a century Simia has been a favorite summer resort to which Britons from all over India have gone to escape the heat of the plains. The first European house was built in 1819. The winter population of the city is approximately 30,000. The area of the district is 101 sq. mi., with a population of approximately 45,000.

SIMILAR FIGURES. Two figures, $ABCD \dots$ and $A'B'C'D' \dots$ are *similar* if they can be so placed that lines AA' , BB' , CC' , DD' , EE' , \dots all pass through the same point O so that $AO:A'O = BO:B'O = CO:C'O = DO:D'O = EO:E'O = \dots$ and so on for all other pairs of points in the respective figures formed by cutting these figures by lines of the pencil having the vertex O in the way here shown. The constant ratio $AO:A'O$, etc., is called the ratio of similitude, and the point O is called the center of similitude. The figures may be either plane or solid.



SIMILAR FIGURES

The above are similar figures. They may be either plane or solid. Speaking more simply but less scientifically, figures which have the same shape, but not necessarily the same size, are said to be similar. In the first of the above figures, if the ratio of similarity is 1, that is, if $AO = A'O$, $BO = B'O$, \dots , the figures are said to be symmetric with respect to O , the center of symmetry.

SIMILE, bringing out the resemblance of one object or thing to another object or thing of a different class by comparing the two, as "to run like lightning." The comparison is introduced by a word such as "like" or "as," although in some cases, especially where the comparison is worked out at length, the connective is not necessary. The simile must not be confused, however, with an ordinary comparison between two things of the same class. It promotes

clearness of thought and may add to the emotional force of an idea, but is usually weaker than the METAPHOR.

BIBLIOGRAPHY.—A. Bain, *English Composition and Rhetoric*, 1872; A. S. Hill, *The Principles of Rhetoric*, 1895.

SIMMONS COLLEGE, at Boston, Mass., a technical college for women, was the first collegiate institution of this character to be established in the United States. It was founded in 1899 through money left by John Simmons, a merchant of Boston. The productive funds in 1931 amounted to \$2,541,125. The library contained 48,600 volumes. In 1931-32 there were 1,574 students and a faculty of 148, headed by Pres. HENRY LEFAVOUR.

SIMMS, WILLIAM GILMORE (1806-70), American author, was born Apr. 17, 1806, at Charleston, S.C. He began practicing law, but in 1828 became editor of *The Charleston Gazette*. This failed and Simms turned to literature. He wrote voluminously with great financial success. He edited *The Southern Literary Review* for a time, and except for Poe, was the South's outstanding man of letters before the Civil War. He lost his money and, to a great extent, his following during the war and never regained them. In his novels—stories of vigorous narrative and vivid description centering around pioneer or Revolutionary characters—he has been placed second to J. F. COOPER. His short stories are found in two volumes, *The Wigwam* and *The Cabin*, 1845-46, and his biographies of Southern heroes have been praised by critics. Simms died in Charleston, S.C., June 11, 1870.

SIMON COMMISSION, the British commission of inquiry sent to India in 1928 to study the governmental developments since the granting of the 1919 constitution. The commission was created by the British Parliament at the end of 1927. It was headed by Sir John Simon, and consisted entirely of British Members of Parliament. Its object was to inquire into conditions in India and to advise on what progress, if any, should be made toward self-government. The commission arrived in India Feb. 3, 1928, but was met by considerable opposition from the Nationalist groups in India on the grounds that it contained no Indian members and that India should have the determining voice in its own affairs. After a tour of some months, the commission returned to England, and then made a second trip to India. It tried to secure from the Indian leaders a clear-cut set of proposals as to what would be acceptable to all the different groups, but disagreements between the Hindus and Moslems made this impossible. The commission submitted an elaborate report in May, 1930, containing proposals as to what steps should be taken, but developments in India had increased and altered the demands of the Indians so much that the proposals were inadequate as the basis for the Round Table discussions in 1930 and 1931.

SIMONIDES OF AMORGOS (c. 650 B.C.), Greek poet, also known as Semonides of Amorgos, was born at Samos in the 7th century B.C. He founded a colony on the Island of Amorgos. The best of his extant

poems is *Peri Gynaikon*, a satire which compares women with different kinds of animals. Simonides also wrote the early history of Samos, besides considerable elegaic and iambic poetry in the Ionic dialect.

SIMONIDES OF CEOS (d. 469 B.C.), Greek poet, was born at Julis in Ceos, about 556 B.C. He lived in Athens until the death of Hipparchus in 514, then went to Thessaly; after the Battle of Marathon he returned to Athens, but ended his days at the court of Hieron in Sicily. While in Ceos he wrote paeans for festivals of Apollo and taught music and poetry. He took a prize for his elegy on the heros of Marathon and wrote a number of patriotic epigrams of the dead; his poetry also included Bacchic songs, odes and dirges. Noted for his unusual power to produce pathos, he was popular and had considerable influence. According to tradition Simonides instituted the distinction between the long and short vowels in the Ionic alphabet. He died in 469 B.C.

SIMON PURE, in Mrs. Centlivre's comedy, *A Bold Stroke For A Wife*, 1718, a Pennsylvania Quaker who, on a visit in London, is nearly victimized by an imposter, Feignwell. The phrase "Simon Pure," attesting genuineness, originated with this character.

SIMON THE CANAANITE, one of the twelve disciples of Jesus, is included in all four of the canonical lists of the Apostles. Matthew and Mark call



ST. SIMON

From an engraving by the master, "E. S."

him the "Canaanite," while Luke calls him "the Zealot," which may mean that he was once a member of the Zealot party, or that he was simply "zealous for the law" as others described by Luke. Some have believed that he was from Cana in Galilee and that he was the bridegroom of the marriage feast where Jesus turned water into wine. From the New Testament we learn nothing more of him. Tradition is liberal in locating his missionary fields, and almost

every land of the known world has been mentioned. His relics are reported from Babylonia to Toulouse in Gaul. One set of legends places him in Babylonia and on the shores of the Black Sea. Greek writers

represent him as a missionary in Egypt, Mauretania and Britain; but as Simon Peter (*see* PETER, SAINT) is also located in these places, he was probably confused with him. He has also been confused with Nathaniel, by the Copts and Greeks. His day is observed with St. Jude's (*see* JUDE, SAINT) on Oct. 28.

SIMONY, the offense of buying or selling spiritual offices or privileges for monetary or other material considerations. The term is derived from Simon Magus, who wished to purchase



ST. SIMON

After an engraving by Martin Schongauer

from the Apostle Peter the power of conferring the Holy Ghost (Acts, 8:18). By the primitive Church simony was regarded as a sin against the Holy Spirit, and was consequently punished with the utmost severity. At first applied to the buying and selling of sacred objects and spiritual privileges, the term was gradually expanded to include the sale and purchase of ecclesiastical offices and ecclesiastical patronage. The canon law of the Roman Catholic Church provides excommunication for simoniacs. In England simony is punishable by the ecclesiastical law of the realm; in the United States, which has no established church, it is not a civil offense.

SIMPLICIUS, ST., Pope from 468 to 483, was born in Tivoli. His pontificate embraced the latter part of the period of barbarian domination in the West, the fall of the Western Empire and the deposition of Romulus Augustulus, a child made emperor by Orestes. He opposed the heresies of the time.

SIMPLIFIED PRACTICE consists in eliminating unnecessary diversity in any commodity, and concentrating production on varieties in greatest demand. It is based on a survey showing the quantity of each size or variety of the commodity produced during a given period. Such a survey usually shows at least 80% of production in less than 20% of variety. Producers, distributors, and users then voluntarily cooperate to establish a simplified list of "stock" sizes or varieties which will cover all ordinary demand. The United States Department of Commerce frequently cooperates in developing such a project, and publishes the result as a Simplified Practice Recommendation. Each recommendation is kept flexible through periodic review by the industry.

The function of simplified practice is selective and commercial, whereas that of STANDARDIZATION is creative and technical. Simplified practice is often under-

taken as a preliminary to standardization, since it reduces the number of items to be standardized. Simplified practice does not reduce the total production of any commodity, and may increase it by reducing costs.

The widest and most useful applications of simplified practice are found in mass-produced commodities in everyday use, in which style or individuality are not important. Simplified practice is an essential factor in waste elimination. It reduces costs, stabilizes employment, and directly benefits the consumer.

E. W. E.

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SIMPSON, SIR JAMES YOUNG (1811-70), British physician, was born at Bathgate, Scotland, June 7, 1811. He received his degree in medicine from the University of Edinburgh in 1832. In 1835 he became lecturer on pathology there and president of the Royal Medical Society. In 1840 he became professor of midwifery and in 1847 physician to Queen Victoria. In 1846 he made the first use of ether as an anesthetic in surgical operations in England, and in 1847 for the first time used chloroform as an anesthetic and made the first application of it to childbirth. He was knighted in 1866 and died at Edinburgh, May 6, 1870.

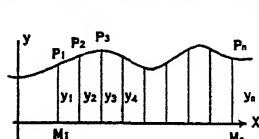
SIMPSON, MATTHEW (1810-84), Methodist Episcopal bishop and educator, was born at Cadiz, O., June 20, 1810. Educated at Madison College, now Allegheny College, Meadville, Pa., he became a physician, but gave up his practice early to study for the ministry. After holding pastorates at Pittsburgh and Williamsport, Pa., he was appointed professor of natural science at Allegheny College in 1837. He was president of Indiana Asbury, later De Pauw University, from 1839 to 1848. In 1852 he was elected a bishop of his church. *One Hundred Years of Methodism* (1876) and an *Encyclopedia of Methodism* (1878) are his best known writings. Lincoln regarded him as the greatest orator that he had ever heard, and Bishop Simpson officiated at the martyred President's funeral at Springfield, Ill. He died at Philadelphia, Pa., June 18, 1884.

SIMPSON AND DEASE, EXPLORATIONS OF. In 1837 Thomas Simpson and Peter Warren Dease, two officers of the Hudson's Bay Company, set out from Fort Chipewyan, on Lake Athabasca, under instructions "to endeavor to complete the discovery and survey of the northern shores of the North American continent." They reached the mouth of the Mackenzie on July 19, and were at Franklin's farthest point, Return Reef, fourteen days later. When ice-packs drove the party's boats inshore, the indomitable Simpson turned out to sea and doubled the packs; when ice-fields blocked further progress, he left Dease with the boats and marched overland with five men to Point Barrow. After wintering at Fort Confidence, which they built on Dease Bay, Great Bear Lake, in 1838 the explorers crossed to the Coppermine, descended that river to its mouth, and marched to Cape

Alexander before a scarcity of provisions forced a return. Again wintering at Fort Confidence, in 1839 the explorers were enabled by favorable ice conditions to reach Cape Alexander by boat; continuing along the coast, they reached their farthest point, Castor and Pollux Bay. After exploring the south shores of King William Land and Victoria Land, they reached the mouth of the Coppermine on Sept. 16, 1839, after a record Arctic journey of 1,408 geographical miles. They had definitely established the existence of a practicable water channel between the northern coast of the continent and the great Arctic islands.

SIMPSON COLLEGE, at Indianola, Iowa, a co-educational institution, was chartered in 1867 as Simpson Centenary College. It received its present name in 1884. The institution is privately controlled and affiliated with the Methodist Episcopal Church. The productive funds in 1931 amounted to \$1,100,000. The library contained 22,000 volumes. In 1931-32 there were 545 students and a faculty of 40, headed by Pres. John L. Hillman.

SIMPSON'S RULE FOR AREAS, a convenient device for finding approximate areas under a curve, and often known as Simpson's Trapezoidal Rule. It



was invented by Thomas Simpson (1710-61). In measuring the area under the curve here shown we take an odd number of ordinates, $y_1, y_2, y_3, \dots, y_n$,

with a common distance u between them. Then the approximate area (A) is found as follows:

$$A = \frac{1}{3}u[(y_1 + y_n) + 2(y_3 + y_5 + y_7 + \dots) + 4(y_2 + y_4 + y_6 + \dots)].$$

SIMROCK, KARL (1802-76), German poet and medievalist, was born at Bonn, Aug. 28, 1802. He was educated at Bonn and Berlin and appointed professor at Bonn in 1850. He is noted for his translations of old German legends, sagas and poetry, including his rendering of the *Nibelungenlied*, published in 1827. He also translated Shakespeare's plays into German. Among his other works are *Gedichte*, 1844, *Laude Sion*, 1850, and *Handbuch der deutschen Mythologie*, 1853-54. Simrock died at Bonn, July 18, 1876.

SIMS, JAMES MARION (1813-83), American gynecologist, of South Carolina, was graduated from Jefferson Medical College, Philadelphia, in 1835. Locating in Alabama, he devoted himself to surgery and achieved considerable success in surgical treatment of abscess of the liver and removal of the upper and lower jaw. He is particularly noted for his gynecologic work and a position and speculum bear his name. In 1852, he published a paper describing his operation for fistula, which created a profound impression. Sims moved to New York in 1853 and established the State Hospital for Women in 1855, and this hospital soon became a leading gynecologic center. He visited Europe in 1861 and demon-

strated his surgical technique in fistula and was soon in demand to do operations on women. He wrote several books and papers and among them was his volume *Clinical Notes on Uterine Surgery*, which was translated into German. Sims was highly esteemed by Germany's leading gynecologists. A statue to his memory was erected in 1894 in Bryant Park, New York City. M. F.

SIMS, WILLIAM SOWDEN (1858-), American naval officer, was born at Port Hope, Ontario, Canada, Oct. 15, 1858, of American parents. After graduating at Annapolis in 1880, he served on various war vessels and in 1897-1900 was connected with the American embassies at Paris and St. Petersburg as naval attaché. During 1902-09 he was inspector of target practice in the navy, being responsible for the institution of the methods now used. In 1907 he became naval aide to President Roosevelt, with the rank of commander, and in 1911 he was made captain, having returned to active service. In 1917 Sims was appointed president of the Naval War College, his tenure being temporarily interrupted by the European conflict. In the World War, Sims, as rear-admiral and vice-admiral, commanded the United States warships in Europe. He made a report in 1920, charging the Navy Department with many blunders in operations.

SIN, a religious, ethical or moral term, defined in the Westminster Shorter Catechism as "any want of conformity into or transgression of the Law of God." Sin may be of omission or commission; as it is expressed in the Anglican Prayer Book, "we have left undone those things which we ought to have done and done those things which we ought not to have done." In Roman Catholic theology, a distinction is drawn between mortal sin, cutting off the soul from grace, and venial sin, which is less serious in spiritual results. The seven deadly sins are pride, lust, covetousness, anger, gluttony, envy and sloth. Sin, which may consist of thought, word or deed, thus covers a wider range than crime, which word is limited to offenses against the state. When sin is committed, guilt is incurred, involving punishment in this world and, according to Christian and other eschatology, in a future life. Pardon for sin has been sought in all ages and countries by the disturbed conscience of mankind. Repentance of heart, works of penance and piety, pilgrimages and prayer have accompanied the desire for pardon. In the Jewish and other ceremonial, the sacrifice of an animal as sin bearer was included, which idea of expiation for the guilt of sin is inherent in the Christian doctrine that the crucifixion of Jesus, as Redeemer of the world, was an atonement of sin.

SINAI, the triangular peninsula lying between Egypt, South Palestine, Arabia and the Red Sea, the traditional home of the national god Yahweh and the Biblical site of the mountain on which Moses received the tablets of the law. As early as 5000 B.C. its mines of turquoise were being worked by the Egyptians and in later centuries its copper mines be-

came famous. In early Christian days many hermits inhabited the caves of Sinai, and monasteries were built on its heights. The name, Sinai, may perhaps be connected with Sin, the Babylonian moon-god.

SINALOA, a state of Mexico, occupying a long stretch of the west coast of the republic. It has an area of 27,557 sq. mi. It is shaped something like a cornucopia, wide at the north, and tapering almost to a point at the southern extremity. The southern part of the state is almost due south of El Paso. The Sierra Madre Mountains traverse the eastern portion of the state, and slope to a sandy plain on the coast. The mountain slopes are covered with dense forests and many kinds of plants. Some important rivers traverse the state, and are navigable for a part of their length. Among these are the Culiacan, the Fuerte and the Sinaloa. The climate is tropical along the coast, and more temperate in the mountains, and there is an abundant rainfall over most of the state. Agriculture is the chief industry, and some of the products are fruit, vegetables, tobacco and especially tomatoes. The capital is Culiacan, and other cities are Mazatlan, an important port, Fuerte and San Blas. Pop. 1921, 341,265; 1930, 385,512.

SINBAD THE SAILOR, the hero of a tale of that name in the *ARABIAN NIGHTS*. He is a merchant of Bagdad who has acquired his wealth after making seven voyages in strange parts of the world in quest of costly merchandise. He recounts the adventures and perils of these seven fantastic voyages for the benefit of Hindbad, his discontented porter. All are in the extravagant, colorful vein of the *Arabian Nights*.

SINCLAIR, MAY, English novelist, was born at Rock Ferry, Cheshire. She was educated at the Ladies' College, Cheltenham. She began early to write verse and philosophical articles, turning to fiction in 1895. *The Divine Fire*, 1904, brought her fame in England and America. Among the best known of her works are *The Tree of Heaven*, 1917, *Mr. Waddington of Wyck*, 1921, *Ann Severn and the Fieldings*, 1922, *The Three Bronies*, *The New Idealism*, *The Allinghams*, 1927, *Tales Told by Simpson*, 1930, and *The Intercessor and Other Stories*, 1932.

SINCLAIR, UPTON (1878-), American author, was born in Baltimore, Md., Sept. 20, 1878. He was graduated from the College of the City of New York in 1897, and studied at Columbia University. His best known books are *The Jungle*, 1906, a study of the stockyards in Chicago, and *The Brass Check*, 1919, a novel dealing with American newspaperdom. Others of note are *Jimmy Higgins*, 1919, *The Goose-step*, 1923, *Oil*, 1927, *Boston*, 1928, *Roman Holiday*, 1931, and *The Wet Parade*, 1931; also a play, *Singing Jailbirds*, 1924. Sinclair has been a tireless and persuasive propagandist for social and political reforms.

SIND, the most northern province of the Presidency of Bombay. Area 52,994 sq. mi. The region consists of a broad alluvial plain with the Indus running through the center. Rice is the main crop on vast irrigated areas. The province was subdued by the Moguls in 1580. Since then it has al-

ways been either nominally or really tributary. At the end of the 18th century its government was a wholly unchecked military despotism, upheld by feudal soldiery. The country was invaded by British troops and conquered in 1843, and soon after annexed to Bombay. Pop. 1921, 3,472,529; 1931, 3,593,304.

SINGAPORE, a small island, and the city on that island, close to the extreme southern end of the Malay Peninsula. The city, located roughly half way between China and India, has been an important trading center since the early days of modern western trade in Far Eastern waters. It was taken over by the *BRITISH EAST INDIA COMPANY* in 1819 and incorporated into the *STRAITS SETTLEMENTS* crown colony in 1826. It is the most important city in the crown colony, and an important link in British Far Eastern trade. The harbor has been heavily fortified as a naval base, and is well developed for commercial purposes. Tin and rubber are the two most important export items. The economic life of the region is largely dominated by Chinese who in recent generations have settled there in large numbers. The climate is hot and humid. Pop., of the island, 1931, 557,802.

SINGLE TAX, an economic doctrine advocated by *HENRY GEORGE*. In 1879 he published a book entitled *Progress and Poverty*, which attracted wide attention, and many became his devoted disciples. He asked the question why, since "the present century (the 19th) has been marked by a prodigious increase in wealth producing power" should "poverty still persist." His answer was that the benefit of all progress accrues solely to the landowners, who receive an unearned increment of value and exact ever increasing rents for the private use of land, which God gave for the use of all men.

"What," he asked, "constitutes the rightful basis of property?" He answers, "Labor only." "This right of ownership that springs from labor excludes the possibility of any other right of ownership." Land cannot be created by labor. Hence, "Private property in land is a bold, bare, enormous wrong." So he proposed an annual tax on land equal to its full rental value. This he held was the only source of income which the government was justified in taking and hence would be the sole or single tax. The answer to his theory is to be reached by an examination of how the institution of private property in land works. Is it beneficial to society or not?

C. C. P.

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SINKIANG, known as the New Dominion, consisting of Chinese Turkestan, Kulja and Kashgaria, together with all Chinese dependencies lying between Mongolia on the north and Tibet on the south. It is regarded as a separate Chinese province, its governor residing at Urumchi, the capital. Sinkiang's area is 550,340 sq. mi. The inhabitants are of many races, chiefly Turki, Kalmuk and Khirghiz. Mohammedans and Chinese dominate and are rapidly increasing.

Along the Kashgar and Yarkand rivers the soil is good and extensive irrigation lends it fertility. Cereals, fruits and vegetables are the principal agricultural products and there is extensive wool, cotton and silk production. Sinkiang furnishes China and the world with considerable jade; there is some gold. Trade is mostly with India, Afghanistan and China. The chief towns are Ili, Kashgan, Yarkand, Khotan and Aksu. Many Chinese are immigrating into the territory to engage in farming. Pop. 1,200,000.

SINKING FUND, the setting aside by governments and corporations each year sums of money calculated to pay off their debts in a certain time. Of course, the annual contribution to this fund must be from income saved. To borrow in order to keep up a sinking fund is merely creating a new debt to pay an old one.

In 1792 an English clergyman named Price wrote an "appeal to the Public on the Subject of the National Debt" in which he argued that by setting compound interest to work any debt could be paid off with almost magical certainty and rapidity. The idea was for the government to buy up its own Bonds, a few at a time, continue to pay interest on all of them, including those which it owned, and use that interest to buy up more bonds until it had them all. He failed to see that the only real source of debt payment was the excess of TAXATION over expenditures, and that it would be quite sufficient to cancel the bonds bought up. It is only when bonds cannot be called in or bought at a reasonable price that the sinking fund need be invested as it accumulates.

C. C. P.

SINKIUSE, a division of the Cœur d'Alene, a North American Indian Salishan-speaking people. They occupied the eastern banks of the Columbia River from Fort Okinakane to the vicinity of Pt. Eaton, Wash.

SINKYONE, a North American Indian tribe belonging to the Pacific Coast branch of the Athapaskan linguistic stock. They occupied formerly the south fork of Eel River, Humboldt co., Calif., with villages on Bull and Salmon creeks, as well as the territory to Shelter Cove on the coast and southward to Usal. The people were often called Usal, and those on Bull and Salmon Creek were known as Lokano. Although at one time transferred to the Hupa Indian Reservation, a few survivors now live in their old habitat. Linguistically they were closely related to the WAILAKI. They lived in conical bark houses, made twined baskets and practised cremation.

SINN FEIN, a separatist party formed in 1900 to obtain self-government for Ireland. The movement was organized by Arthur Griffith and other patriots, who first advocated passive resistance for members of their Society of the Gaels. The name was changed to Sinn Fein, meaning in Gaelic "ourselves alone" or, colloquially, "stand together." After 10 years, passive resistance was discarded for active measures against British rule. Civil War was averted, however, by the opening of the World War. In 1916 the Easter Ris-

ing again brought home to England the Irish insistence on home rule. In Dec. 1918, Sinn Fein candidates nominated on a platform demanding complete independence were elected by a majority representing seven-tenths of the electorate. Accordingly an Irish Parliament, the Dail, was organized, and Eamonn De Valera was chosen president of the Irish Republic. The Anglo-Irish War between the British armed forces, the Black and Tans, and the Irish separatists consisted of guerilla fighting during 1919-21. In the latter year England by the Anglo-Irish Treaty, which Griffith supported, granted dominion status to 26 southern counties, comprising the Irish Free State, and restricted dominion status to eight northern counties and parliamentary boroughs, organized as the government of Northern Ireland or Ulster. After this victory the Sinn Fein party organization ceased to exist as an active separatist instrument.

SINO, the term used to indicate China in conjunction with the names of other countries, e.g., Sino-Japanese instead of Chino-Japanese.

SINO-JAPANESE WAR, 1894-95, the first move in modern Japanese territorial expansion. The conflict grew in part out of difficulties between the Japanese and Chinese as to their respective authority in Korea, and in part out of the Japanese desire to secure closer access to coal and iron and other raw materials in the Chinese mainland. The immediate cause was a clash between Chinese and Japanese troops which had gone into Korea, the former at the request of the Korean authorities, to assist in the suppression of a rebellion. War was declared Aug. 1st, 1894, and the Japanese forces were quickly successful. Peace negotiations started early in 1895. Most of China knew very little about the war and was not concerned with it.

The peace treaty was signed Apr. 17, 1895, at Shimonoseki. This gave Japan the island of Formosa, and the lower end of the Liaotung Peninsula in Manchuria as well as an indemnity of Taels 200,000,000 (U.S. \$150,000,000). China also was compelled to recognize Korean independence, thereby surrendering her nominal suzerainty over the country. Before the ratification of the treaty, Russia, Germany and France acting together demanded that Japan return the Liaotung Peninsula holdings, in order to preserve the territorial integrity of China. Japan yielded, but received an additional indemnity of Taels 30,000,000 (U.S. \$22,500,000). In 1895 and 1898 Britain, Germany, France and Russia made large loans to China which enabled her immediately to pay off the war indemnity.

The prompt defeat of China by Japan in this war called the attention of the Western powers to Chinese weakness, and opened a way to the scramble for concessions, spheres of influence, and special rights in which the powers engaged during the next five years. Japanese success, followed by the humiliating demands of Russia, Germany and France, materially strengthened the determination of Japan to secure army forces which would enable her not only to pro-

teet herself, but to meet the Western nations on terms of equality.

SINON, in Greek mythology, a relative of Ulysses. (*See ODYSSEUS*.) Sinon joined the expedition against Troy and gained entrance to the city by allowing himself to be taken captive. Pretending to be a traitor he persuaded the Trojans to admit the wooden horse, saying that it was an atonement for the stolen Palladium. When the horse was within the walls, Sinon released the Greeks hidden in it, whereby the siege was ended.

SINO-TIBETAN, a LINGUISTIC FAMILY comprising Tibetan, Burmese, Chinese and Siamese (*see* separate articles on these languages). It is characterized by a trend toward monosyllabism, most highly developed in Chinese, although there is reason to believe that at an earlier period the words consisted of more than one syllable; by a consequent poverty in inflectional endings which seem once to have existed, so that the same word may appear as a noun, adjective, verb, etc., its use being indicated by its context, by its position in the sentence, or by combining it with words formerly independent but now acting merely as prepositions, etc. (technically termed "empty words"). It is also characterized by a tendency to change initial sonants into surds, and by a system of tones or voice-pitch which serves to distinguish homonyms, or words of identical form but different meaning.

L. H. G.

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SINUSES AND SINUSITIS. The so-called nasal accessory sinuses are air cavities, hollowed out of the bones of the skull, varying in size, lined with a thin, moist mucous membrane, closely related and emptying into the nose. The two large air cells above the eyes are the frontal sinuses; those beside the eyes are the ethmoid sinuses; those in the cheeks are the maxillary sinuses, better known as the antra of Highmore. Far back in the nose are two cells, known as the sphenoid sinuses.

In good health the sinuses contain only air. Their function is not definitely known, but the hollow chambers may act as air cushions to keep too cold air from striking the brain or nerves. Some of them are present at birth and others develop later. In some persons the sinuses may be large, ramifying widely in the skull, and coming into contact with vital structures such as the brain, and its coverings, as well as blood vessels, nerves, and such organs as the eyes and the teeth.

The sinuses are usually infected in the course of the ordinary head cold. A severe cold, that is, an acute catarrhal rhinitis, can very easily extend to these air cells, because every one of them communicates with the nasal passages. Inflammation of the sinuses is known as sinusitis. Just as a head cold may be mild or severe, so the signs of sinus trouble may be minor or so prominent that they cause great suffering and distress, and even threaten the patient's health and life. Perhaps the chief symptom of sinus

trouble is inordinate discharge from the nose persisting long after a common cold has run its course. Pain is also a frequent though not universal accompaniment of a fresh and severe attack. This pain is usually but not necessarily about the region of the



FROM MAXIMILIAN VON WIED-NEUWIED'S TRAVELS

TENT OF AN ASSINIBOIN CHIEF

affected sinus. Headache may accompany inflammations of the air cells. Because of their close connection with important structures, serious disease of the brain and eyes may follow sinusitis, but fortunately these complications are not common.

The symptoms described apply chiefly to the forms of sinus disease called acute. There are types of sinus trouble which last for many months or years, hence called chronic, in which the chief complaint may be excessive discharge from the nose with perhaps frequent headaches. There are also forms of sinus trouble in which there is a tendency for soft jelly-like growths to form in the nose, producing obstruction to breathing, called polyps. (*See POLYPUS*.) Because neglected head colds may lead to the chronic forms of sinus trouble, all prolonged and excessive attacks of discharge from the nose should receive prompt and capable attention. The nature of chronic sinusitis is such as to make its treatment difficult. Operations are often resorted to, frequently with disappointing results. The acute cases of sinus disease usually get well, particularly if assisted by able medical attention.

S. J. P.

SIOUAN, a North American Indian linguistic stock, and next to the Algonkian the most populous linguistic family north of Mexico. They formerly occupied three general regions: a large territory extending with interruptions west from the Mississippi



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KICKING BEAR, A SIOUX
WARRIOR

River almost to the Rocky Mountains and from the Arkansas River north into Canada in the vicinity of Lake Winnipeg; the central part of North and South Carolina and the Piedmont region of Virginia; and two small sections in Mississippi. The first Siouan



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SIoux WOMAN

A skin-covered frame for carrying her papoose is beside her

to be seen by white men were the QUAPAW, encountered in Arkansas by De Soto in 1541. In 1804-05 Lewis and Clark passed through the center of Siouan territory and encountered most of the tribes. The majority of the eastern tribes and of the southern tribes belonging to the western division raised maize. The Crow and the majority of the Dakota depended upon buffalo-hunting and the buffalo played a leading rôle in their economic and religious life. Shelters of the eastern tribes were bark and mat wigwams; on the Plains earthlodges and also skin tipis were characteristic. Domesticated dogs were used for transporting luggage until the horse, which revolutionized the life of the Plains Indians, was introduced by the white men. The Siouan family in 1931 numbered approximately 40,000. Principal linguistic divisions of the tribes are as follows:

- A. Dakota-Assiniboin
 - a. Eastern, or Santee Dakota. 1. Mdewakanton. 2. Wahpekute. 3. Sisseton. 4. Wahpeton.
 - b. Yankton.
 - c. Yanktonai
 - d. Teton. 1. Brulé. 2. Oglala. 3. Sans Arc. 4. Blackfoot. 5. Miniconjou. 6. Two-kettle. 7. Hunkpapa.
 - e. Assiniboin. 1. Stoney. 2. Turtle Mountain Sioux.
- B. Dhegiha. 1. Kansa. 2. Omaha. 3. Osage. 4. Ponca. 5. Quapaw.
- C. Chiwere. 1. Iowa. 2. Missouri. 3. Oto. 4. Winnebago.
- D. Mandan.
- E. Hidatsa. 1. Crow. 2. Hidatsa.
- F. Biloxi. 1. Biloxi. 2. Ofo.
- G. Eastern. 1. Catawba. 2. Tutelo. 3. Many extinct tribes.

SIoux CITY, a city and riverport in western Iowa, the county seat of Woodbury Co., situated on the Missouri River at the mouth of the Big Sioux, 100 mi. north of Omaha, Neb. Bus and truck lines, river craft and six railroads make it an important shipping center. The Rickenbacker Airport, with a flying school, is near by. The second largest city in the state, Siouan City is an industrial center, with flour mills, machine shops, glove and clothing factories, and busy packing houses and stock yards. In 1929 the industrial output amounted approximately to \$133,000,000; the retail trade reached a total of \$52,696,787. The countryside produces farm crops and live stock. Trin-

ity, Morningside and Briar Cliff colleges are located here. This region was once an Indian camping ground. It was visited by the Lewis and Clark explorers in 1804, and Sergeant Charles Floyd of the expedition is buried on the bluffs near by. Theophile Brughier of the American Fur Co. settled here and married a Yankton Siouan woman. In 1854 John K. Cook founded Siouan City, which was incorporated in 1857. Pop. 1920, 71,227; 1930, 79,183.

SIoux FALLS, a city in southeastern South Dakota, the metropolis of the state and the county seat of Minnehaha Co., situated on the Big Sioux River, 90 mi. north of Siouan City, Iowa. Buses, trucks and five railroads serve the city, which is a trading market for a large area. There is an airport. The chief agricultural interests of the region are corn, small grain and live stock. The local industries include meat packing, stone quarrying and the manufacture of biscuits, confections and dairy products. In 1929 the factory output was valued approximately at \$47,000,000; the retail business in 1929 amounted to \$25,301,797. Located here are Siouan Falls College, Augustana College and Normal School, Columbus College for Girls and All Saints School for Girls. Siouan Falls was founded in 1857; incorporated as a city in 1883. The falls of the river lend beauty to the city and supply water power. Pop. 1920, 25,202; 1930, 33,362.

SIPHON, or **SYPHON**, a device for conveying a liquid from a container to a lower level over an intermediate point which is higher than the surface of the liquid. It consists of any inverted "U"-shaped tube having one side longer than the other. The siphon is put in operation by filling the tube and permitting it to drain from the long side while the end of the short side is immersed in the container. This, in effect, creates a vacuum in the tube so that the liquid is forced over the bend by the pressure of the air. The siphon will not convey a liquid of the density of water over a point higher than 33 ft. above the level of the liquid.

SIPHONAPTERA, the name of an order of parasitic insects known commonly as fleas. They are very small, wingless insects, and can jump relatively tremendous distances. There are some 500 species, all external parasites on mammals and birds. The eggs are laid about the nest, lair or house of the host, and the worm-like larvæ feed on organic refuse. Fleas develop in filth, and a really clean dog house offers no better breeding ground for them than a really clean house.

SIPHUNCULATA, the term used by some entomologists to designate the order of true lice. Anoplura is an older term for this order, and one more generally used. These are wingless parasitic insects. Mouthparts are fitted for piercing and sucking. Lice develop without metamorphosis. They feed by sucking the blood of the host. Bird lice do not belong to this group of insects.

SIREN, in Greek mythology, one of the sea nymphs, daughters of Phorcys the sun god, or of

Achelous and a nymph. They dwelt on an island off the coast of Italy near Sicily, where by their song they lured navigators to their destruction. Ulysses (*see* ODYSSEUS) was able to pass only by stuffing the ears of his crew with wax and tying himself to the mast. ORPHEUS saved the Argonauts by outdoing the Sirens in singing.

SIREN, the common name for members of the family of two-legged amphibians (*Sirenidae*). There are two species, both found in the muddy waters of the southeastern United States. They have eel-like bodies, with a pair of short legs near the head, and feathery external gills. The larger species (*Siren lacertina*), known as the "mud-eel," grows to be 2½ ft. in length, while the smaller (*Pseudobranchius striatus*) grows only about 7 in. long.

SIRENIA, the scientific name for the order of aquatic ungulates, which includes the sea-cows or manatees and the dugongs. These mammals look a bit like the issue of a cross between seals and porpoises. They are more thoroughly adapted to the water than the former, but less so than the latter. Female dugongs often float at the surface, holding their babies in their flippers, and in this position remind one of the sirens or mermaids of mythology, whence comes the name of the order. Sirenians are vegetarians, and live in the warm shallow seas and estuaries. *See also* DUGONG; MANATEE.

SIRICIUS, ST., bishop of Rome, 384-398, and Saint. He was the author of the first papal decretals which have survived.

SIRIUS, in classical mythology, the faithful dog of ORION. After Orion had been slain accidentally by DIANA, through the machinations of APOLLO, he was laid by the grief-stricken goddess in the heavens, where he may still be seen in the constellation bearing his name, followed by Sirius, the Dog Star.

SIRIUS (*Alpha Canis Majoris*), the brightest star in the sky. The name, meaning the brilliant, is derived from the Greek and Sanskrit. In about 3,000 B.C. the HELIACAL RISING of Sirius coincided with the beginning of summer and indicated that the Nile was about to overflow. Symbolic of this role of announcer, Sirius was called the Dog Star. It is a white star, only 9 light years distant, 2.5 times heavier and 27 times brighter than the sun, and is accompanied by a very faint star revolving around it in 50 years at an average distance of 190 million miles. From the irregularities in the motion of Sirius the existence of the companion was known before it had ever been seen. This companion is a WHITE DWARF almost as heavy as the sun, about 100 times fainter, but in bulk not much larger than the earth. Its density is 10,000 times greater than that of water. *See* STAR: *map*.

SIROCCO, a strong, dry and hot south wind that blows in southern Italy, coming from the desert regions in northern Africa. On account of the amount of fine, hot sand the sirocco carries it actually scorches and kills vegetation.

SISAL HEMP, a valuable cordage fiber obtained from a Mexican species of *Agave* (*A. sisalana*), closely

resembling the century plant. Sisal hemp, sometimes called hennequen, ranks second in strength only to abaca or manila hemp among the world's cordage fibers. The plant, a native of Yucatan where its cultivation is an important industry, is grown also in parts of Central America and the West Indies. In preparing the fiber the leaves, usually 4 to 5 ft. long, are cut off at the base and at the outer end and transported in bundles to scraping machines which separate the pulp from the long, yellowish-white, straight, smooth fiber. Sisal hemp is extensively used for making binder twine and similar cordage, and also for bags, hammocks and other articles.

SISKIN, a small bird (*Spinus spinus*) of the Finch family (*Fringillidae*) native to temperate Europe and Asia. Like the goldfinch, to which it is closely allied, the siskin is prized as a cage bird, both for its bright plumage variegated with yellow, olive green and black, and for its pleasing song. It is about 4½ in. long, and of rather stout build. As a wild bird it breeds in coniferous regions throughout its range building a neat nest in trees or bushes and laying usually five speckled bluish eggs. The somewhat larger pine siskin (*S. pinus*) breeds in the coniferous belt of Canada and far southward in the higher mountains of the United States migrating irregularly southward.

SISSETON, one of the seven primary divisions or "council fires" of the DAKOTA, belonging to the Siouan linguistic stock and living in various parts of Minnesota. The tribe was subdivided into the Sisseton proper and the Kahra. They seem to have formed a link between the eastern and western Dakota tribes but are generally classed with the eastern division. After 1853, when their population was estimated at 2,500, they were gathered on the Lake Traverse reservation.

SISTERS OF CHARITY, a name applied to a number of religious congregations of women within the Roman Catholic Church. The best known of these organizations is called the Sisters of Charity of St. Vincent de Paul. It was founded by St. Vincent together with Louise de Merillac and Mlle. Le Gras at Paris in 1633 to carry on charitable work among the needy and sick. The Sisters add to the usual three vows a fourth, to serve the sick; the vows are renewable each year. Their society is spread throughout the world. They conduct hospitals, orphan asylums and schools. The flaring white cap which they wear is known as a cornette. The order was introduced into America by Mother Elizabeth Ann Seton who founded the first house at Emmitsburg, Md., in 1809.

Another community, which refused to join in the affiliation with the French Vincentians, was founded by some of these Sisters in New York, in 1846. The mother-house is at Mt. St. Vincent, near Yonkers. These Sisters adhere to the small black cap originally adopted by Mother Seton. The Sisters of Charity of the General Hospital of Montreal, with branches throughout Canada and in the United States, are known as Grey Nuns. Somewhat similar organiza-

tions are the Irish Sisters of Charity, the Sisters of Charity of St. Paul the Apostle, of Jesus and Mary, of Our Lady Mother of Mercy, of St. Louis, and other titles.

SISTOVA. See SVISHTOV.

SITKA, one of the sub-tribes of the important North American Indian Tlingit group, belonging to the Koluschan linguistic stock. They occupied Baranof Island and the southern part of Chichagof Island, Alaska.

SITKA, an incorporated town and seaport of southeastern Alaska, in the first judicial division, situated on Baranof Island, in the Alexander Archipelago, about 100 mi. southwest of Juneau; served by steamships and submarine cables. Gold and silver mining, salmon fishing and canning, fur and lumber industries are among the leading interests. Sitka has an American colony and Indian village; public schools for whites and for natives; a Government experiment farm; coaling and wireless stations; churches and a museum.

In 1799 a Russian trading company established Fort Archangel Gabriel a few miles distant from the present site of Sitka. Five years later Sitka, then New Archangel, was founded and became the commercial center of Alaska. It was the scene of the official taking over of Alaska by the United States in 1867, and the capital until 1906. Rain, snow and cloudy weather mar two-thirds of every year, though the climate is comparatively mild. Pop. 1920, 1,175; 1930, 1,056.

SITKA NATIONAL MONUMENT, an area of great natural beauty located on Sitka Bay in southeastern Alaska. A tract of about 57 acres, reserved as a public park by President Harrison in 1890, was established as a national monument March 23, 1910. Sixteen totem poles, collected from the Tlingit and Hydah tribes of Prince of Wales Island, are the chief objects of interest in the monument. These poles are of red cedar elaborately carved and gayly painted; several of them are unequalled as examples of the work of Alaskan Indians. The site of an ancient village of the Kik-Siti Indians is also included. The monument is 1 mi. by automobile from the town of SITKA, which is a port of call for steamships.

SIUSLAW, a North American Indian tribe now practically extinct, belonging to the Yakonan linguistic stock. They lived on the Siuslaw River in Oregon. The few individuals now surviving live on the Siletz Reservation in Oregon.

SIVA or **SHIVA**, a god of modern Hinduism, who as Mahadeva, or Great God, is the most popular deity of India. He is known also as Mahayogi, or the Great Ascetic. Mt. Kailasa is his particular heaven, and Benares, his chief seat on earth. He has many forms and names, according to geographical location and religious function, and with him are linked many gods and goddesses. Among the latter are his wives, including Kali who is the Goddess of Bengal. To his own sect of followers he is all things to all men, whether as the object of personal devotion (*bhakti*)

and meritorious works, or with his family and attendants the Destroyer of demons and the Protector, or as the mighty force within nature and the Redeemer of mankind.

SIVAS, a city of Turkey in Asia Minor and capital of the vilayet of the same name, situated on the banks of the Murdan-Su in the valley of the Kizil-Irmak and connected by rail with Angora and Erzurum. Sivas is well-built and contains many old inns, bazaars, mosques, and gardens. It is noted for the remains of the *medresses*, or colleges, built by the Seljuks. The throne of Senkherim is preserved as a relic in the Armenian monastery of the Holy Cross near there. The town is built on the site of ancient Sebastia and was for many centuries one of the foremost cities in Asia Minor; Romans, Seljuks, Byzantines and local amirs having governed it at various times. During the capture of Sivas by Timur the Tatar in the 14th century, it is said that 4,000 Armenians were buried alive in the ruins. Pop. 1927, 56,180.

SIWERTZ, PER SIGFRID (1882-), Swedish novelist, was born at Stockholm, Jan. 24, 1882. His first literary work was a collection of poems, *Dreams of the Street*. This was followed by three collections of short stories, *Margot*, *Circles* and *Old Folks*. His most important fiction work is the two-volume novel, *Selams* (translated into English under the title *Downstream*). A more recent novel is *Goldman's*, which deals with life in a great department store in Stockholm. Among his other novels are *Malay Pirates*, *Officials in Search of Adventure*, *Flaneur*, *Reflected Fire* and *Home from Babylon*. The scenes of most of his stories are laid in the region about Stockholm.

SIX NATIONS, a confederacy of six Iroquoian tribes, the Cayuga, Mohawk, Oneida, Onondaga, Seneca and Tuscarora, formed by the admission of the Tuscarora in 1722 to the confederacy known as the Five Nations. See IROQUOIS.

SIX-PART VAULT, a type of groined vault developed in the late Romanesque period in Normandy, and much used in French early Gothic work, in which the diagonal groins spanned two of the church bays, so that the cross vaults on each side from alternate pairs of clerestory windows came together in a point. A magnificent modern example of the six-part vault exists in the nave of the Cathedral of St. John the Divine, in New York, by Cram and Ferguson. See VAULT.

SIXTEEN TO ONE, a slogan of the Democratic Party in the campaign of 1896, alluding to the demand in the party's platform for "the free and unlimited coinage of both silver and gold at the present legal ratio of 16 to 1 (i.e., at a fiat valuation of 16 parts of silver as equal to one part of gold) without waiting the aid and consent of other nations." See FREE SILVER.

SIXTOWNS CHOCTAW, one of three divisions of the CHOCTAW, a North American Indian tribe belonging to the Muskogean linguistic stock.

SIXTUS, name of 5 popes. St. Sixtus I, 116-125, alleged martyr. St. Sixtus II, 257-258, saint and martyr in the Valerian persecution. St. Sixtus III, 432-440, saint and builder of Santa Maria Maggiore in Rome. Sixtus IV, 1471-84, set the example of plunging Italy into war for the sake of building up the temporal power of his nephew. Sixtus introduced the inquisition in Spain, but also beautified Rome with fine buildings, including the Sixtine Chapel. Sixtus V, 1585-90, a Franciscan monk of great experience, was equally able as administrator, builder, economist, scholar and statesman, and his reign, during which Protestantism was a vital issue, was powerful and energetic.

SIZING, in textile manufacturing, the process of treating yarn with a glutinous material, a softener, or both in order to improve the weaving qualities of the yarn. Sizing materials most commonly used are STARCH, dextrin, and emulsified or emulsifiable oils or fats. Application of size tends to increase the tensile strength, stiffness, and compactness of the yarn; secure greater cohesion between the yarn elements; decrease chafing; and prevent fuzziness. Sizing is especially important in the case of cotton, rayon and spun silk; but it is also necessary in the preparation of warps for the manufacture of the finer qualities of woollens and worsteds.

In the preparation of the sizing bath, starch or other agglutinants are boiled with water and the necessary amount of softener is added. Although size may be applied to yarn in skein or package form, the most common method is by passing the completed warp through a trough or tank containing the size and then drying it, this being done while winding the yarn from one beam to another. This process is called warp sizing; or in the case of cotton yarn, slashing.

The term sizing is applied also to that part of the finishing process in which starch, dextrin, fillers, and softeners are applied to woven fabrics. W. W. C.

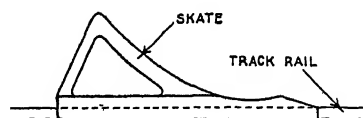
BIBLIOGRAPHY.—Bean and Scarisbrick, *Chemistry and Practice of Sizing*.

SKAGIT, a sub-group of the NISQUALLY, a North American Indian Salishan-speaking tribe. They live at the mouth of the Skagit River in Washington and on parts of Whidbey Island. Several hundred survivors of the group now live on Swinomish Reservation in Washington.

SKATE, the common name for a numerous family (*Rajidae*) of rays widely distributed in the colder seas. They have a broad, exceedingly flat body, a stout distinct tail, pectoral fins extending forward to the snout, a small mouth on the under side of the body, and a more or less spiny skin. Skates live near the bottom and are omnivorous feeders. They are oviparous, the eggs being enclosed in large four-cornered, leathery cases, 3 to 8 in. long. The American species, although usually edible, are held in but slight esteem for food. In 1929 the total catch in United States waters, amounting to 1,779,000 lbs., was valued at only \$27,000. Among the best known North Ameri-

can species are the common or tobacco-box skate (*Raja erinacea*), about 1½ ft. long with a very spiny skin, found from Nova Scotia to South Carolina; the similar big skate (*R. diaphanes*), about 3 ft. long, found from the Gulf of St. Lawrence to Virginia; the barndoor skate (*R. stabuliformis*), often 6 ft. long, occurring from Nova Scotia to Florida, and the California skate (*R. binoculata*), of the Pacific coast. See also RAY.

SKATE, for railroads, a metal device used for stopping cars. It is shaped so that the wheel mounts



COURTESY, N. Y. CENTRAL LINES
STANDARD RAIL SKATE PLACED ON TOP
OF RAIL

and rides upon it, the sliding friction between the skate and the rail stopping the car.

SKATING (Figure and Speed), the sport of gliding over ice by means of skates with metal runners. This form of transportation has a history dating from at least the 11th century, at which time the Icelanders were known to use primitive skates constructed from horn and animal bones. As the art of skating became known to Europe, its utilitarian aspects were supplanted by its exploitation as a sport. In 1642 Edinburgh boasted a skating club. Others were soon organized in northern Europe and in America. In the 19th century international skating matches were held both for figure and for speed skating. The Internationale Eislauf Vereinigung now holds annual competitions in both classes for the world skating championship. Figure, or fancy skating, was originated by the English in the 19th century. The aim is to glide around the rink in symmetrical figures, loops, cross-cuts and grapevines, generally using only one skate to execute a given design while the other foot is suspended. This form of skating, which approximates dancing on ice, is extremely graceful when executed by experts. Speed is not required; but a delicate sense of balance is essential.

The speed skating records have been bettered in recent years due to a marked improvement in the design of the skate, now set in a hollow aluminum tube. While the Norwegian skaters hold most of the speed championships over all distances, American skaters have established some interesting records. In 1887 T. Donoghue covered a mile in 2 min., 12¾ sec., and in 1930 Jack Shea covered 220 yards in 18½ sec. National skating contests for speed over varying distances are staged annually throughout the United States and Canada.

In the 1932 Olympic Winter Games held at Lake Placid, N.Y., Jack Shea, of the United States, won the 500- and 1,500-meter races, Irving Jaffee, also of the United States, the 5,000- and 10,000-meter events. Figure-skating champions were Karl Schaefer, of Aus-

tria, Sonja Henie, of Norway, and M. and Mme. Pierre Brunet, France.

SKEAT, WALTER WILLIAM (1835-1912), English philologist, was born at London, Nov. 21, 1835. In 1858 he was graduated from Christ's College, Cambridge, where in 1860 he became a fellow. He left the ministry to devote himself to researches in English philology and literature at Cambridge. In 1873 he was co-founder of the English Dialect Society, being appointed its first director. He was appointed professor of Anglo-Saxon at Cambridge in 1878. Skeat's important work on middle English literature includes the three parallel texts of *Piers Plowman*, the Oxford edition of Chaucer, and important editions for the Early English and Scottish Text societies. His greatest work in philology is the *Etymological English Dictionary*, four parts, 1879-82, which was revised and enlarged in 1910. He died at Cambridge, Oct. 7, 1912.

SKELETON, the framework of the body or that portion of an organism which gives it its rigidity, supports soft structures, and furnishes a system of levers for the action of muscles. Lower forms, as insects and shellfish (Crustacea) are supported by a firm outside covering called an exoskeleton which serves at once for protection and for the purposes just enumerated. Higher animals (Vertebrates) are supported only by an internal skeleton composed of separate bones rich in lime salts. Some groups, however, as the turtles, are in addition protected by a bony exoskeleton.

While man possesses many bones not found in the lowest vertebrates, a definite common plan of skeletal structure is evident through all vertebrated animals if they be arranged in a presumably natural series. (See COMPARATIVE ANATOMY.)

The bones may be divided into two classes: axial and appendicular. The axial skeleton includes the skull and vertebral column; the appendicular comprises the bones of the extremities and their girdles, whether fins, wings, flappers, arms or legs. The axial skeleton is less subject to change in various forms than the appendicular, as its function remains the same in all forms.

The vertebral or spinal column consists of a series of small bones in the mid-line of the body, from the base of the skull to the tip of the tail, if present. In man there are thirty-three such vertebrae. Regional differences in appearance have led them to be divided into groups. The cervical vertebrae (Fig. 1, C.V.) are seven in number, and are situated in the neck. The dorsal or thoracic vertebrae (T.V.) articulate with the ribs, and are twelve in number. The succeeding five, the lumbar (L.V.), form the bones of the small of the back. The five sacral vertebrae are joined to form one bone, the sacrum (Sa.), as are likewise the last four, the coccygeal, forming the coccyx (Co.).

Each vertebra consists of a block-like piece of bone, the centrum (Ce.), and a neural arch attached by its bases to the back of the centrum, and enclosing the

spinal cord. A spinous process projects behind from the crest of the neural arch, and transverse processes may be directed laterally from the site where the arch joins the centrum. The centra increase regularly in size as one passes down the vertebral column. The cervical vertebrae, besides having small centra, are pierced for the passage of the vertebral artery on either side. The thoracic vertebrae have long, oblique, spinous processes and articular facets for the ribs. The lumbar vertebrae are characterized by long transverse processes.

The sacrum assists in the formation of the pelvis, of which it forms the keystone. It presents the form of a triangle, with its base uppermost. Evidence of its compound origin is seen in the four pairs of canals through it for the exit of the sacral spinal nerves. In man, the coccygeal vertebrae are fused to form a triangular button dependent from the lower end of the sacrum. In most mammals, however, there is a long series of coccygeal vertebrae supporting the tail.

There are twelve pairs of ribs (*Rib.*), of which all except the lowest two (floating ribs) are united in front, through the intervention of the costal cartilages (C.C.), to the vertically disposed sternum (*St.*), thus forming a barrel-shaped cavity, the thoracic cavity. Each rib is a narrow, flattened, curved slat of bone. The end which articulates with the thoracic vertebrae presents a small rounded knob, the head (*H.R.*), attached to the shaft by a slightly constricted neck (*N.R.*). The sternum is an elongated flat plate consisting of three pieces. The highest segment, roughly hexagonal, is the manubrium (*Ma.*). The middle segment, the longest, is the body. The xiphoid process (*Xi.*) depends freely from the lower end of the body.

The upper extremity, comprising the arm and shoulder girdle, has only the loosest bony connection to the axial skeleton. Most of its support is given by the muscles which connect these two portions of the skeleton (see MUSCULAR SYSTEM). The collar-bone of clavicle (*Cl.*), curved like the italic letter *f*, connects the shoulder-blade or acapula (*Sc.*) with the sternum. The scapula is a flat plate, triangular in shape, with extensive muscular attachments, lying at the upper part of the back of the thorax. The acromion (*Ac.*) and the coracoid process (*Cr.*) are two heavy projections at its upper part which serve chiefly for the attachment of muscles. The outer apex is thick and concave. During life this concavity is deepened by a cartilaginous rim, forming the glenoid fossa, into which fits the head of the humerus or arm bone (*H.H.*). During extensive movements of the arm, the scapula slides along the chest wall, turning the while with the tip of the acromion, where it is attached to the clavicle, as a pivot.

The humerus (*H.*) is quite long, but enlarged at the ends. Its hemispherical head is attached directly to the upper end of the bone, at an angle. Its upper end is marked in front by two roughened elevations for the attachment of muscles, the greater and lesser

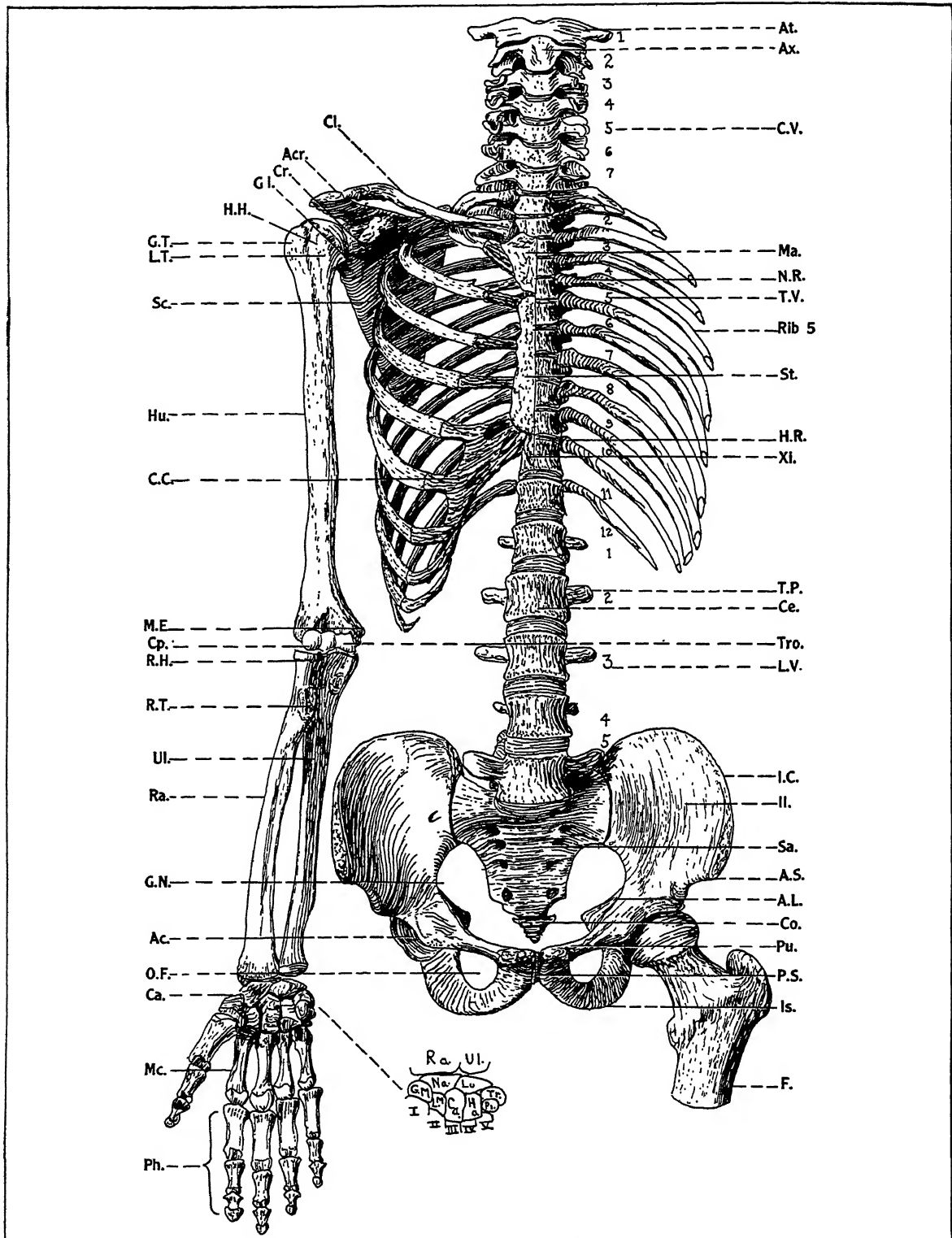


FIG. 1. BONES OF THE HUMAN TRUNK AND RIGHT SUPERIOR EXTREMITY, WITH FRONT OF THE LEFT SIDE OF THE THORAX CUT AWAY

Ac., acetabulum; Acr., acromion; A.L., arcuate line; A.S., anterior superior iliac spine; At., atlas; Ax., axis; Ca., capitate; Ca., carpus; C.C., costal cartilage; Cl., clavicle; Co., coccyx; Cp., capitulum; C.P., coronoid process; Cr., coracoid process; C.V., cervical vertebrae; Gl., glenoid fossa; G.M., greater multangular; G.T., greater tubercle; Ha., hamate; H.H., head of humerus; H.R., head of rib; I.C., iliac crest; Il., ilium; In., innominate bone; Is., ischium; I.S., anterior inferior iliac spine; L.M., lesser multangular;

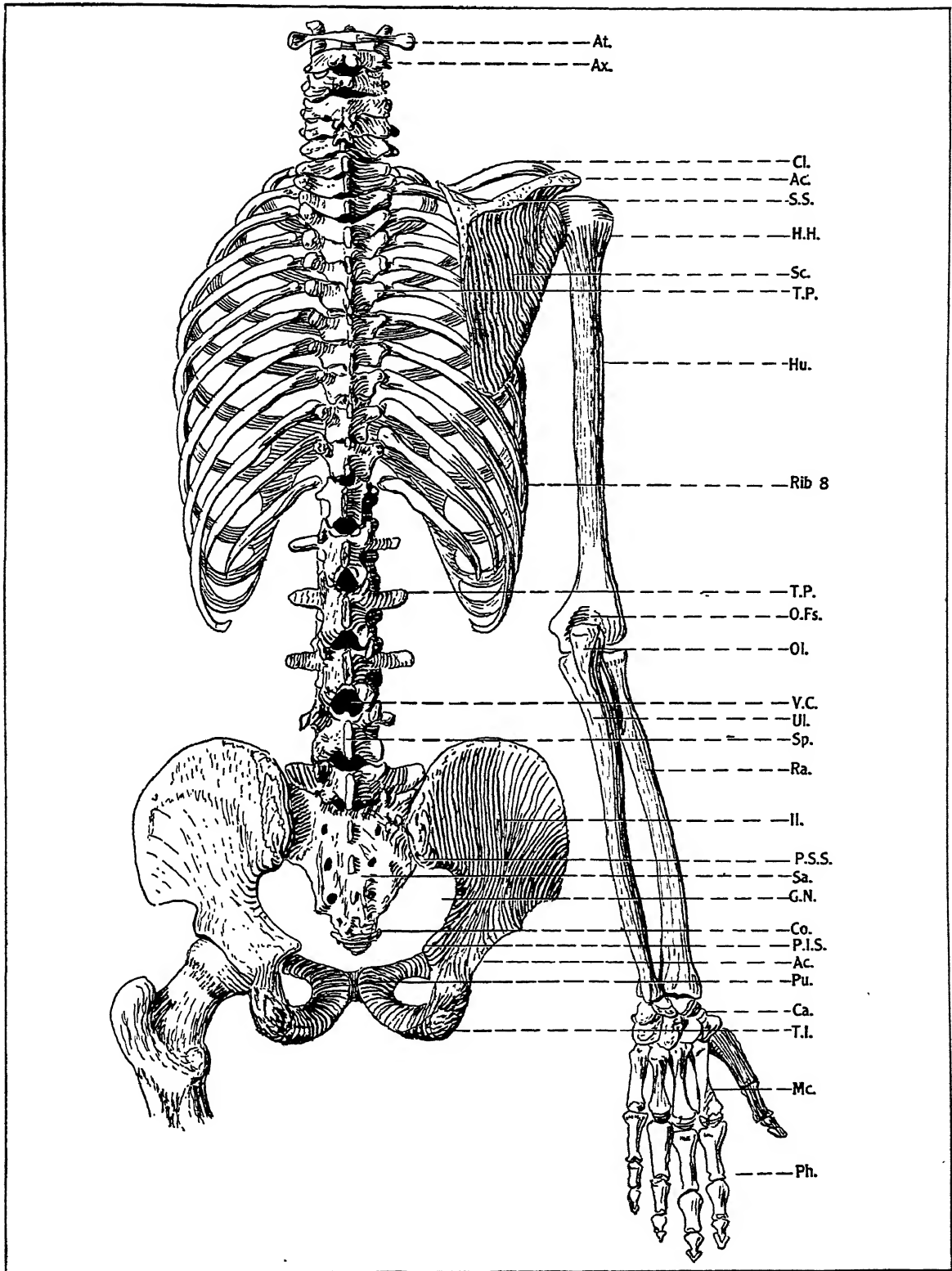


FIG. 2. BACK VIEW OF THE BONES ARRANGED AS IN FIGURE 1

L.T., lesser tubercle; Lu., lunate; L.V., lumbar vertebrae; Ma., manubrium; Mc., metacarpus; M.E., medial epicondyle; Na., navicular; N.R., neck of rib; O.F., olecranon fossa; O.F., obturator foramen; Ol., olecranon; Ph., phalanges; Ps., pisiform; P.S., pubis; Ra., radius; Ul., ulna; V.C., vertebral canal; Xi., xiphoid process

tubercles (*G.T.*; *L.T.*), which are separated by a groove for the tendon of the biceps muscle (*see* MUSCULAR SYSTEM). Its lower end is flattened in front and behind and terminates in a complexly curved surface for articulation with the forearm bones, the radius and ulna.

These two bones are of approximately the same size and lie parallel to each other. The upper end of the ulna (*Ul.*) is larger than that of the radius, however, and presents a heavy upward projection, the olecranon process, forming the prominence of the elbow. Contrariwise, the lower end of the radius is the larger, and is the only one of the pair to articulate directly with the bones of the hand. This arrangement of bones enables the hand to be turned so that the palm is either forward or backward. These movements are termed supination and pronation, respectively. The ulna remains fast, but the radius rotates, carrying with it the attached hand.

Below the forearm there are eight bones, arranged in two rows, forming the carpus (*Ca.*) of the hand. Attached to their distal surfaces are the five metacarpal bones (*Mc.*), to each of which is attached a series of three phalanges (*Ph.*) (two only in the thumb).

The bones of the inferior extremity correspond fundamentally with those of the upper extremity. The girdle of the lower limb is much more firmly attached to the axial skeleton, since it must support the weight of the body. The two hip-bones (*In.*), formed by the secondary fusion of three elements on either side, are united together in front at the pubic symphysis (*P.S.*), and behind join firmly onto either side of the sacrum. A ring of three segments, the Pelvis, is thus formed, into the sides of which the thigh-bones are inserted. Each hip-bone is an irregular flattened plate, but is twisted so that one of the surfaces of its upper part is directed forward and medialward, while the corresponding lower portion looks backward, medialward, and upward. The line separating these two portions corresponds to the inlet of the pelvis and is termed the arcuate line (*A.L.*). The upper portion, formed chiefly of the ilium (*Il.*) supports the abdominal viscera. The lower portion is perforated by a large hole, the obturator foramen (*O.F.*). There is a deep hemispherical depression in the outer surface of the middle of the hip, the acetabulum (*Ac.*).

Into this fits the knob-like head of the thigh-bone or femur (Fig. 3, *F.*). Contrary to the situation in the humerus, the head of the femur is separated from the shaft by a long but heavy neck (*N.F.*). As in the humerus, there are two elevations for muscular attachment, the greater and lesser trochanters (*G.T.*; *L.T.*). The shaft of the femur is straight and cylindrical. The lower end is enlarged and has two similar articular surfaces, the medial and lateral condyles, for articulation with surfaces of corresponding name (*M.C.*; *L.C.*) on the upper end of the tibia (*T.*), forming the knee. The knee-cap or patella (*P.*) lies over the front of the knee.

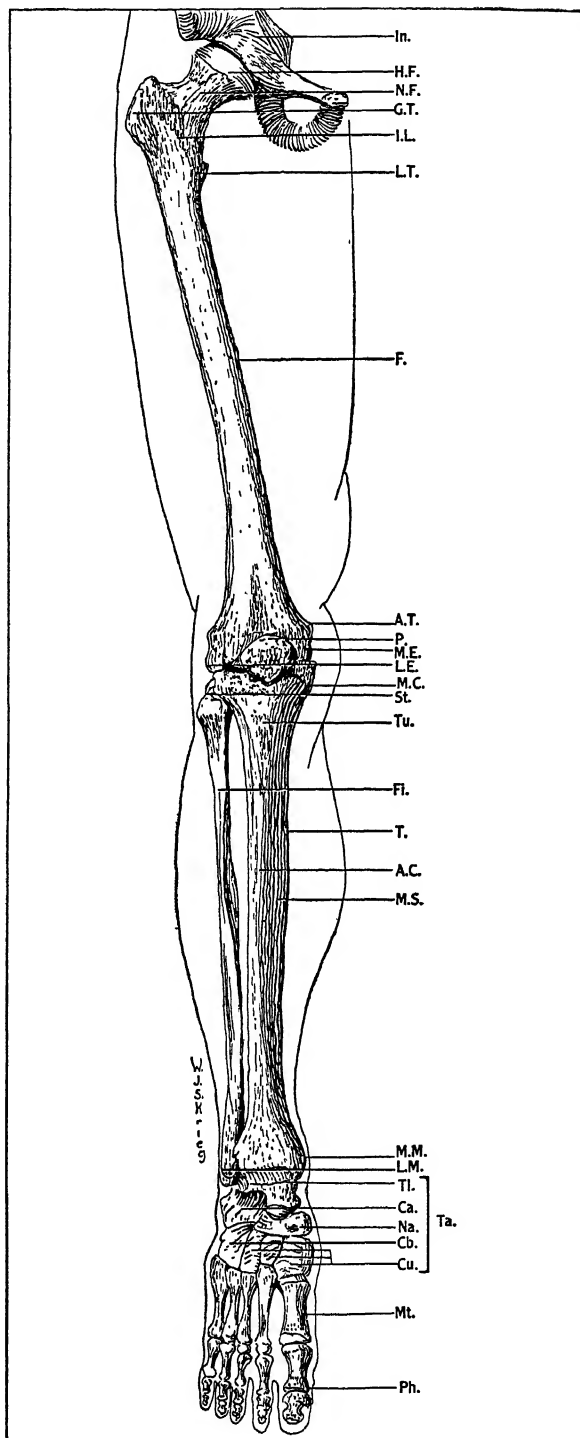


FIG. 3. BONES OF THE HUMAN INFERIOR EXTREMITY, VIEWED FROM BEFORE

A.C., anterior crest; A.T., adductor tubercle; Ca., calcaneus; Ch., cuboid; Cu., cuneiform; F., femur; Fi., fibula; G.T., greater trochanter; H.F., head; I.L., intertrochanteric line; L.E., lateral epicondyle; L.M., lateral malleolus; L.T., lesser trochanter; M.C., medial condyle; M.E., medial epicondyle; M.M., medial malleolus; M.S., medial surface; Mt., metatarsus; Na., navicular; N.F., neck; P., patella; Ph., phalanges; St., styloid process; T., tibia; Ta., tarsus; Ti., talus; Tu., tuberosity

Of the two bones of the lower leg, the tibia is much heavier than the fibula (*Fi.*). The smooth medial surface corresponds to the shin. Elevations on the sides of each of these bones form the ankle.

The structure of the foot is substantially the same as that of the hand, though there are seven small bones, here called tarsal bones, in place of eight. Corresponding to the metacarpals of the hand are the five metatarsals, which join distally to the phalanges of the toes. *See also* SKULL; MUSCULAR SYSTEM; BONE; JOINTS AND LIGAMENTS. W. J. S. K.

SKELETON CONSTRUCTION, a form of BUILDING CONSTRUCTION in which all loads are transmitted to the foundations by a rigidly connected framework of steel or reinforced concrete. The enclosing walls are supported by the girders at each floor level.

SKELTON, JOHN (1460-1529), English poet, was born probably at Norfolk about 1460. He was educated at Cambridge and Oxford. His first writings were translations and elegies. Before 1500 he was appointed tutor to Prince Henry, afterwards Henry VIII, and he wrote a poem on the death of Henry VII. In 1498 Skelton became a clergyman, settling at Diss, in Norfolk. Not long afterward he began composing the satires and comic verse which made him famous. His use of the vernacular, extremely short lines and droll images produced ludicrous effects. Among Skelton's principal works are the poems, *Gariande of Laurell* and the *Ballad on Margaret Hussey*; the humorous *Tunnyng of Elynour Rummyng*; and the satires, *Colyn Cloute*, directed against the clergy and *Why Come ye not to Courte?* The last, a broadside against Cardinal Wolsey, so angered its subject that the poet took refuge in Westminster. He died there, June 21, 1529.

SKETCH-BOOK, THE, a collection of tales and sketches by WASHINGTON IRVING, first published in 1819 as the writings of "Geoffrey Crayon, Gent." This is a book of quiet charm, written in the rich, easy style of one who knew the art of observing life as a sympathetic spectator. It is mellow in its wisdom, droll in its humor. Written in England, it contains several sketches of that country, of odd characters, a country church, an English Christmas, Westminster Abbey and other scenes. An autobiographical thread runs through the book, which also contains Irving's two most noted tales, *RIP VAN WINKLE* and *THE LEGEND OF SLEEPY HOLLOW*.

SKIDEGATE, the name of a division of the HAIDA Indians and the town in which they dwell. It has also been adopted in the modified form, Skitagetan, as a synonym for the Haida linguistic stock. The town is situated on the north shore of Skidegate Inlet on Queen Charlotte Islands, Brit. Col. The old seafaring life, with its dependence on fish food and on wood and bark for utensils, has been almost entirely abandoned. The Skidegate have become Christians, at least nominally, and have adopted the habits and mode of life of their white neighbors.

SKIDI, one of the four tribes of the PAWNEE con-

federacy speaking a dialect of the Caddoan linguistic stock which differs slightly from that of the other Pawnee tribes. Their original territory was along the Loup and Platte rivers in Nebraska. At the present time they are settled at Pawnee, Okla.

SKIDMORE COLLEGE, at Saratoga Springs, N.Y., a privately controlled, non-sectarian college for women, founded in 1911 and chartered in 1916 as the Skidmore School of Arts. In 1917 the charter was amended to allow the conferring of a college degree, and in 1922 the institution became Skidmore College. The productive funds in 1931 amounted to \$761,618. The library contained 25,303 volumes. In 1931-32 there were 675 students and a faculty of 65, headed by Pres. Henry T. Moore.

SKIEN, a city of Norway, capital of the district of Telemark, on the Skienselv and the Drammen-Skien railroad. It has a modern school, district museum and a monument to HENRIK IBSEN, who was born here. The city has wood and paper industries and is engaged in shipping. Pop. 1930, 15,596.

SKIING, the sport of traveling over snow by means of ski. It is first mentioned in records of the 5th century, although unquestionably this means of transportation was used many hundreds of years earlier by Scandinavians, Finns and Lapps. The word ski is probably derived from the Icelandic *scidh*, meaning, piece of wood. Since the middle of the 19th century, when the sporting possibilities of this form of travel were recognized, the ski has undergone considerable development in construction. The modern ski is a long and narrow piece of oak, spruce, hickory or ash, pointed and turned up at the front. In length the ski should measure approximately as high as a man can reach, i.e., an average of 7 feet 6 inches, while the maximum width is 5 inches, and the greatest thickness, occurring beneath the foot, should not exceed 1¼ inches. The bottom surface is sometimes grooved to prevent side slipping. The ski are attached to special boots by straps or other binding. In general there are three sorts of ski travel: over level country, in which the runner accelerates travel by means of a spiked stick, which is prevented from sinking in the snow by a small disk placed above the spike; coasting down slopes, requiring knowledge of turning and swinging; and jumping. The last is accomplished by a fast descent toward a take-off, curved up at the end to throw the runner into the air. This spectacular feat is popular in England and throughout Europe, notably in Switzerland, but it is an art requiring the maximum physical control and balance. Jumps of 190 feet have been recorded. In the United States and Canada, championship ski meets are held annually by the American Ski Association. In the 1932 Olympic Winter Games held at Lake Placid, N.Y., skii events were won by Sven Utterstrom, of Sweden, J. Grottnumsbraaten, of Norway, Birger Ruud, also of Norway, and Veli Saarinen, of Finland.

SKIMMER, a genus (*Rynchops*) of oceanic birds allied to the terns, widely distributed in temperate and tropical regions. They are of medium size,

chiefly black above and pure white below, with very long wings and a short, slightly forked tail. The lower mandible of the bill is compressed like a knife-blade and is much longer than the upper. Skimmers feed by flying swiftly with the lower mandible partly immersed in the water, thus skimming out small fish,



BLACK SKIMMER

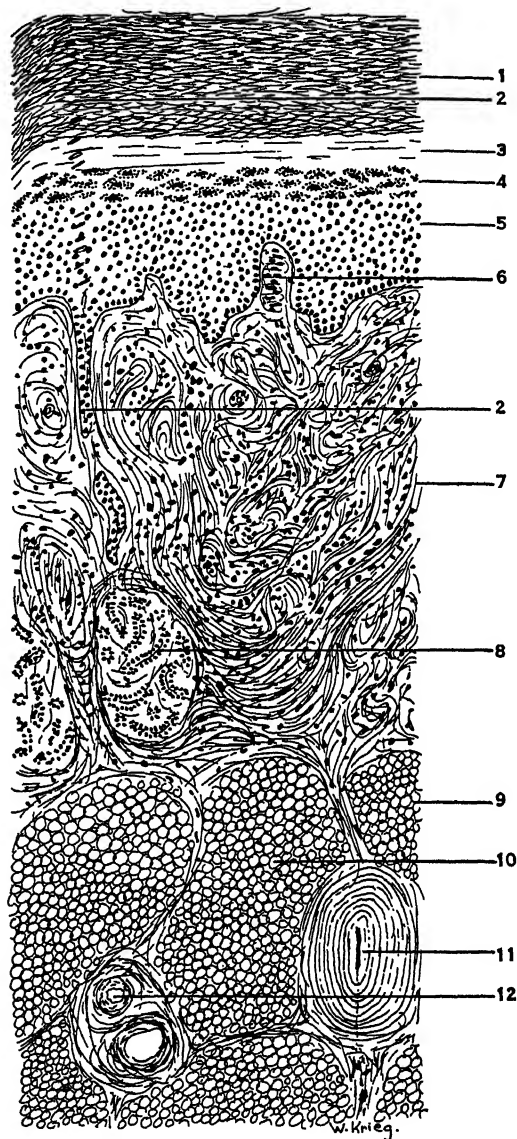
shrimps and other aquatic animals. A single species, the black skimmer (*R. nigra*), is found in the United States, breeding on the Atlantic and Gulf coasts from Texas to New Jersey. It builds no nest but lays three to five eggs in a slight depression in the sand.

SKIN, the covering material of the body. The skin is composed of a number of layers, the relative thickness of which varies in different regions of the body. These layers are grouped into an outer layer, the cuticle; and a deeper layer, the corium or true skin. (See figure.)

The cuticle is free of blood vessels. It is an **EPITHELIUM** of the stratified squamous type. The deepest layers of its cells are in active growth and division, and constitute the stratum germinativum (*S.Ge.*). The more external layers of the cuticle are formed by successive transformations of this layer. External to the germinal layer is a narrow stratum of cells filled with granules, the stratum granulosum (*S.Gr.*). External to this is the stratum lucidum (*S.L.*), which is clear and vitreous. In the palms and soles it becomes quite thick. The layers of cells external to this stratum are flattened and lifeless. It is termed the stratum corneum. Its outer surface is constantly being worn down by friction, and its deeper surface is constantly being added to by the deeper layers of the cuticle.

The corium is composed of close areolar **CONNECTIVE TISSUE**, blood vessels, nerves, and sweat glands. It is composed of an outer papillary layer (*S.P.*), and a deeper reticular layer (*S.R.*). The papillary layer is formed of connective tissue, together with small blood vessels. The reticular layer is coarser in texture, being composed of groups of fat cells, larger blood vessels, the coiled secreting ends of sweat glands, and certain large, laminated, clear, ovoid bodies, into which sensory nerves run. These are the Pacinian corpuscles (*P.C.*), and mediate deep sensibility. Nerve endings are frequent in the various layers of the skin. In addition to the Pacinian corpuscles,

there are corpuscles of Meissner (*M.C.*) just below the cuticle. Some nerves end freely, i.e., without being connected to corpuscles. The various forms of ending are associated with specific types of sensation.



MICROSCOPIC SECTION OF HUMAN SKIN PERPENDICULAR TO ITS SURFACE

1 *S.C.*, stratum corneum (horny layer); 2 *G.D.*, duct of sweat gland; 3 *S.L.*, stratum lucidum (light layer); 4 *S.Gr.*, stratum granulosum (granular layer); 5 *S.Ge.*, stratum germinativum (germinal layer); 6 *M.C.*, corpuscles of Meissner; 7 *S.P.*, stratum papillare (papillary layer); 8 *Gl.*, tubule of sweat gland; 9 *S.R.*, stratum reticulare (reticular layer); 10 *Fat.*, fat cells; 11 *P.C.*, Pacinian corpuscle; 12 *Ar.*, artery

The lower surface of the cuticle is thrown into pits, into which fit the papillae of the corium. These papillae are filled with capillary knots, or are occupied by touch corpuscles of Meissner.

A conspicuous feature of sections of the skin is that of the sweat glands. These consist of a coiled secreting portion (*Gl.*) in the reticular layer, and a long

duct directed toward the surface (*G.D.*). The roots of the hairs are also seen in sections.

For function of skin as organ of excretion, *see* EXCRETION. W. J. S. K.

SKIN DISEASES. *See* DERMATOLOGY; DERMATITIS.

Treatment of. *See* LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

SKIN-DRESSING, in its essentials, the same process among the Indians of North America as it is in modern tanneries. Practically every skin of any appreciable size was used by the Indians. The chief ones were buffalo, elk, deer, antelope, beaver, ermine, jack rabbit and certain large birds. Seal and walrus, salmon and wolf-fish were used by the Eskimo. Women performed most of the work and became expert at turning out beautifully soft skins of uniform thickness. The process varied somewhat among tribes and in different regions but in general the six principal steps were as follows: 1. *Fleshing*, in which the flesh and fat were scraped from the hide by means of a gouge with a serrated edge made from the leg bone of a large animal; 2. *scraping*, a laborious process wherein the hide is staked out hair side up and the hair scraped off by means of a sort of short adze with stone or blade set at right angles to a wood or elkhorn handle; 3. *braining*, or treating with a solution which varied widely but was ordinarily cooked brains, liver and grease; 4. *stripping*, which consisted of squeezing out the surplus dressing mixture by stretching the skin in a frame and drawing a stone tool heavily across the skin and forcing a thin stream of water to ooze out before the blade, after which the skin was left in the frame to dry and bleach; 5. *graining*, done with a globular piece of bone cut from the spongy portion of a humerus of a buffalo or other large animal with which the surface was rubbed to reduce it to uniform thickness and smoothness and to remove any fibers; 6. *working*, or softening, performed by drawing the skin back and forth around a tree trunk or across a rope of twisted sinew stretched between two trees.

SKINK, any lizard of the enormous family *Scincidae*. These harmless creatures are almost universally

West excepted), is readily recognized by its brilliant blue tail and striped pattern. The blue of the tail as well as the stripes are lost with age when the head becomes red. A smaller form, the ground skink (*Leiolopisma laterale*), has a more limited range in the United States and does not exceed 3 in. in length. It is olive-bronze above.

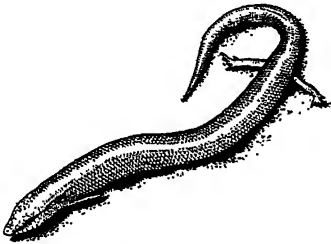
SKINNER, OTIS (1858-), American actor, was born at Cambridge, Mass., June 28, 1858, the son of a pastor. He made his first appearance on the stage at the Philadelphia Museum, in 1877, as Jim in *Woodleigh*. His first New York appearance was in 1879 as Maclow in *The Enchantment*. In his early career he supported EDWIN BOOTH, LAWRENCE BARRETT, MODJESKA, ADA REHAN and JOSEPH JEFFERSON. He is the author of *Mad Folk of the Theatre*, 1928. As early as 1883, when he joined the company of AUGUSTIN DALY, he was recognized one of the most leading figures on the American stage. In 1931-32 Skinner toured with Maude Adams in *The Merchant of Venice*.

SKIN PIGMENTATION. The great range in the skin color of man is dependent principally on three variable factors: the quantity of granular pigment in the deep layers of the epidermis, the blood supply to the dermis and the transparency or thickness of the outermost layers of the epidermis. The amount of oil or sweat on the surface of the skin may also influence the color nuances reflected from the skin.

The pigment factor in skin color is known as melanin; but its exact origin is still somewhat in doubt. Current belief attributes its derivation to the action of specific ferments on albuminous substances in the cell. It is no longer generally held that melanin is the product of special migratory cells. Most of the melanin in the skin is found in the stratum germinativum of the epidermis, although pigment granules may be found in intercellular spaces in the layer above, the stratum mucosum. The melanin itself may vary in color from yellow to black; but its concentration rather than its color is important in determining the color of the skin. If the pigment is diffuse the blood supply in the dermis may show through and impart a rosy or ruddy tint to the skin; or, if the blood supply is less abundant and the outermost layers more opaque, the skin will appear white.

The pigmentation of the skin varies in the different parts of the individual as well as in different races. The darkest coloration is found in the iris of the eye and the areola, or the area around the nipple, and becomes progressively lighter in the following order: external genitalia, back, extended side of the limbs, belly, breast, face, flexed side of the limbs, and finally palms of the hands and soles of the feet.

The skin color of the lighter races may be considerably increased by exposure or tanning, a process which indicates the protective rôle that pigmentation serves. The pigment response to the action of the sun has called forth the hypothesis that the darker races of mankind owe their deeper pigmentation to



SAND SKINK

distributed in both hemispheres. About 15 species occur in the United States. The five-lined skink or "scorpion" (*Eumeces fasciatus*), common over the United States (most of New England and the extreme

the effects of the powerful tropic sun. The solution, however, of racial differences in pigmentation cannot be completely explained by so simple a phenomenon.

Freckling, although more obvious in lighter skinned people, does occur in darker skinned races. It consists of small areas of heavier pigmentation in a field of lighter color. In Europe it is commonly associated with rufous hair and is considered by some authorities to be the result of a mixture of a darker with a lighter skinned individual. Among Mongoloids, and rarely in dark Europeans, a blue spot, known as a Mongolian spot, of varying size may occur in the vicinity of the sacrum. The bluish tinge results from large pigmented cells in the dermis.

In addition, there are a number of pathological conditions which produce a characteristic pigmentation. Among these may be mentioned albinism, which is the congenital absence of pigment in the skin. In complete albinos, the hair is white or pale yellow, the eye is pinkish and the skin white. Leukoderma, or vitiligo, is particularly common in the tropics and results in irregular depigmented patches on the face or body. Addison's disease, a pathological condition of the suprarenal bodies, imparts to the skin a yellow-brown color. H. L. S.

SKINS, hides or pelts of the hog, ox and sheep, used chiefly for leather. After a preliminary treatment the collagen of the hide is converted into leather by the process of tanning. Trimmings go into **GLUE** or **tankage**. Some of the better grades of skin are used for **GELATIN**. The wool of the sheep skin is used for clothing and blankets. The hair of the hog is used for curled hair and felting, and the bristles for brushes. The tail hair from cattle is used for curled hair, paint brushes and upholstery, the body hair for felting and a plaster retarder, while the hair from the ears is used for imitation camels hair brushes.

SKIP, the bucket or other receptacle used in mining for hoisting the mined ore and rock to the surface. The skip is loaded at the shaft stations, and the ore is discharged at the surface into bins to await treatment in the mill. See also **MINING**, **METAL**; **MINING**, **COAL**.

SKIP DISTANCE, the shortest distance from a **RADIO TRANSMITTER** at which a wave (see **ELECTROMAGNETIC WAVES**) which has been refracted by the upper ionized regions of the **ATMOSPHERE** may return to the earth. This distance is a function of the **WAVE-LENGTH** and of the condition of the atmosphere. At wave-lengths of approximately ten meters, a signal will circle the earth and may not return at all. Still shorter waves can be utilized for purely local **BROADCASTING** without interfering with other signals on the same channel, provided the transmitters are located at only moderately distant points. See also **SKY WAVE**. L. G. H.

SKIRMISH, a slight or preliminary engagement in land warfare, normally limited to fire action; a fight between small parties or security detachments, or one in which one side or both seek to avoid a serious engagement.

SKIRRET (*Sium Sisarum*), a tuberous-rooted perennial of the parsley family cultivated as a minor vegetable, chiefly in Europe. The plant grows 3 to 4 ft. high with divided leaves and small white flowers in umbels. The cylindrical, jointed roots grow in large clusters resembling those of the dahlia or sweet potato. Before cooking the woody core must be removed. When properly grown and prepared the skirret is a tender vegetable with a sweet, somewhat floury taste.

SKOPLJE. See **USKUB**.

SKOWHEGAN, a town in Somerset Co., north-western Maine, situated on the Kennebec River, 100 mi. northeast of Portland. The Maine Central Railroad serves Skowhegan. The town produces hay, potatoes, apples, corn and oats. Dairy products and cattle are important assets to the rural community. Skowhegan has saw and woolen mills, factories making shoes, boats and canoes, and also a few small woodworking shops. In the vicinity are summer resorts, lakes, mountains and forest. The first settler, Joseph Weston, came here in 1772. The town was originally called Canaan, and incorporated in 1788. The name was changed to Skowhegan in 1836. Pop. 1920, 5,981; 1930, 6,433.

SKUA, a genus (*Catharacta*) of gull-like seabirds of swift flight and predatory habits, closely allied to the jaegers. In size they are about equal to the largest gulls and have hooked bills and strong claws. Their food consists chiefly of fish stolen from other seabirds, as gulls and terns, which they pursue and attack with hawklike swiftness and violence. Skuas nest on the ground or on bare rock, laying two spotted olive-green eggs. A single species, the great skua (*C. skua*), a bird nearly 2 ft. long with dark brown plumage, occurs in northern North America ranging southward to Newfoundland and Nova Scotia.

SKULL, that portion of the bony skeleton of vertebrate animals which encloses the brain and supports the structures of the face, namely, the eye, ear, nose, and oral apparatus.

There are twenty-two bones in the human adult skull, of which eight surround the brain, and fourteen are related to the face. The evolution of these bones may be traced quite uninterruptedly through the various groups of **VERTEBRATES**. Many of them are formed by the union of constituents, separate in lower forms. Evidence of relation of the adult skull bones to the separate bones of lower forms is seen in the fetal and infant skull, where centers of ossification, or bone-formation, correspond to these primary constituent bones.

The occipital bone may best be seen on a basal view of the skull (Fig. 2). It is shaped like a broad spoon, and has a large oval hole near the handle part of the hollow of the spoon. This is the foramen magnum (*F.M.*). Through it passes the spinal cord to the spinal canal of the vertebral column. On either side are two rounded eminences (*C.A.*) by which the skull articulates with the spinal column. The handle of the fancied spoon is broad, short, and directed for-

ward to articulate with the body of the sphenoid. It is termed the basilar part (*B.P.*). The remainder of the bone completes the skull behind and below.

The parietal bone (*Fig. 1, P.B.*) is a quadrilateral plate, convex exteriorly, which encloses the brain at its upper and lateral parts. Unlike the occipital, this bone is paired.

The frontal bone (*Fig. 1, F.B.*) forms the front of the brain case. At the eyebrows it is continued backward to form the roof of the orbit.

in front of the occipital bone. This, the petrous portion (*P.T.*), conducts the internal carotid artery to the brain through the carotid canal (*C.C.*), and assists in forming a space, the foramen lacerum (*F.L.*), for the exit of the internal jugular vein. The opening of the external ear (*E.M.*) is a prominent hole on the lateral wall of the petrous portion. Below and behind it is a rounded projection, the mastoid process (*P.M.*), containing air spaces accessory to the middle ear (*see EAR*).

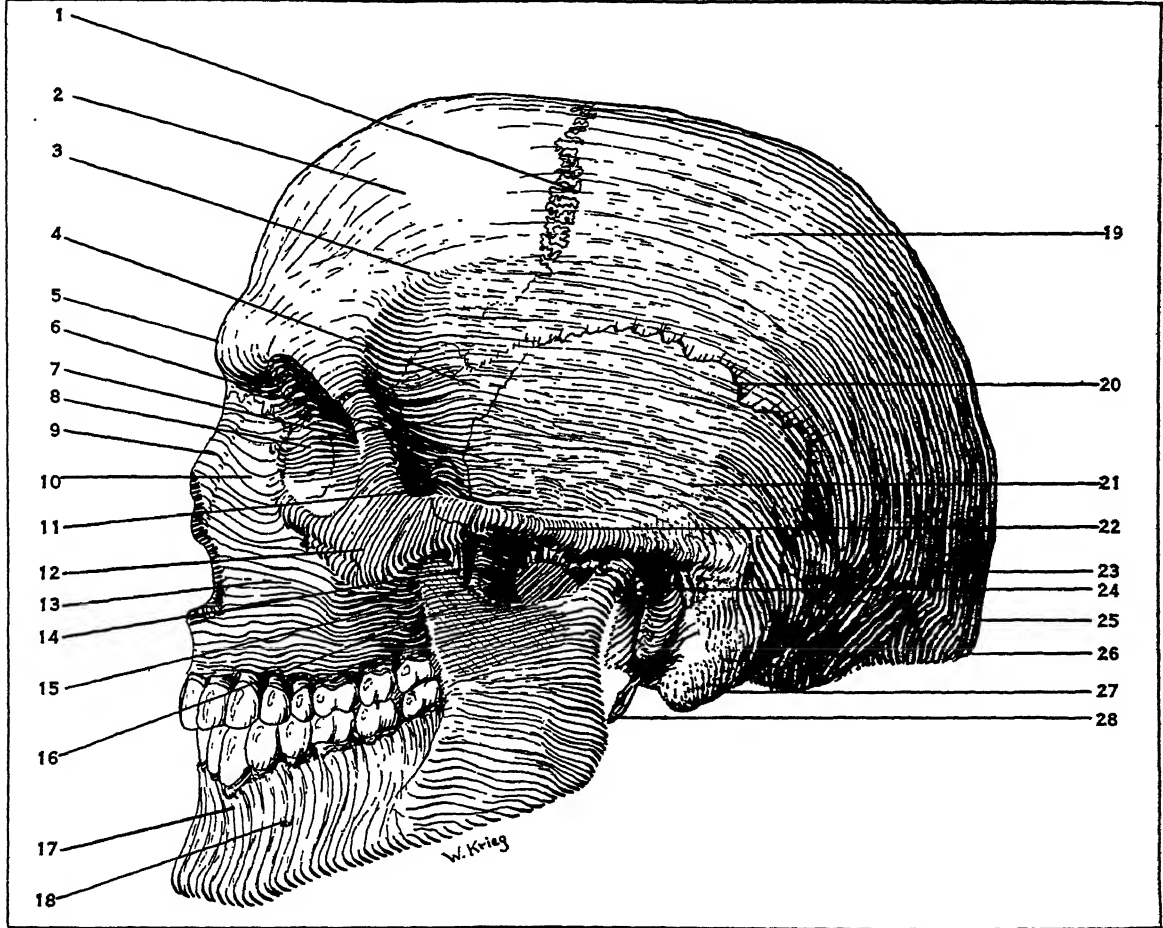


FIG. 1. SIDE VIEW OF THE HUMAN SKULL

1 C.S., coronal suture; 2 F.B., frontal bone; 3 T.L., temporal line; 4 G.W., great wing of sphenoid; 5 S.E., superciliary eminence; 6 T.F., temporal fossa; 7 O., orbit; 8 L., lachrymal bone; 9 N.B., nasal bone; 10 F.P., frontal process of maxilla; 11 I.O., inferior orbital fissure; 12 Z., zygomatic bone; 13 Mx., maxilla; 14 I.F., infratemporal fossa; 15 P.P., pterygoid process; 16 C.P.,

The temporal bone forms the lower part of the sides and a small portion of the base of the skull. It may be divided into two main portions. The squamous portion (*Sq.*) is a flat plate at the side of the skull. A projection, the zygomatic process, is continued forward from its lower part. This, when completed by the zygomatic bone, forms a free arciform bar, the zygomatic arch (*Z.A.*). The remainder of the temporal bone encloses the mechanism of hearing and forms a portion of the base of the skull

The sphenoid bone occupies a central position in the skull, and, since it articulates with twelve bones, may be represented as the keystone bone of the skull. Its shape resembles that of a bat in flight. The great wings (*G.W.*) form the base of the brain cavity in front of the petrous portion of the temporal bone, and are continued on to the sides. Two small wings lie above and in front of the great wings. The pterygoid processes (*P.P.*) are vertical plates projecting downward on either side, corresponding to the legs of a

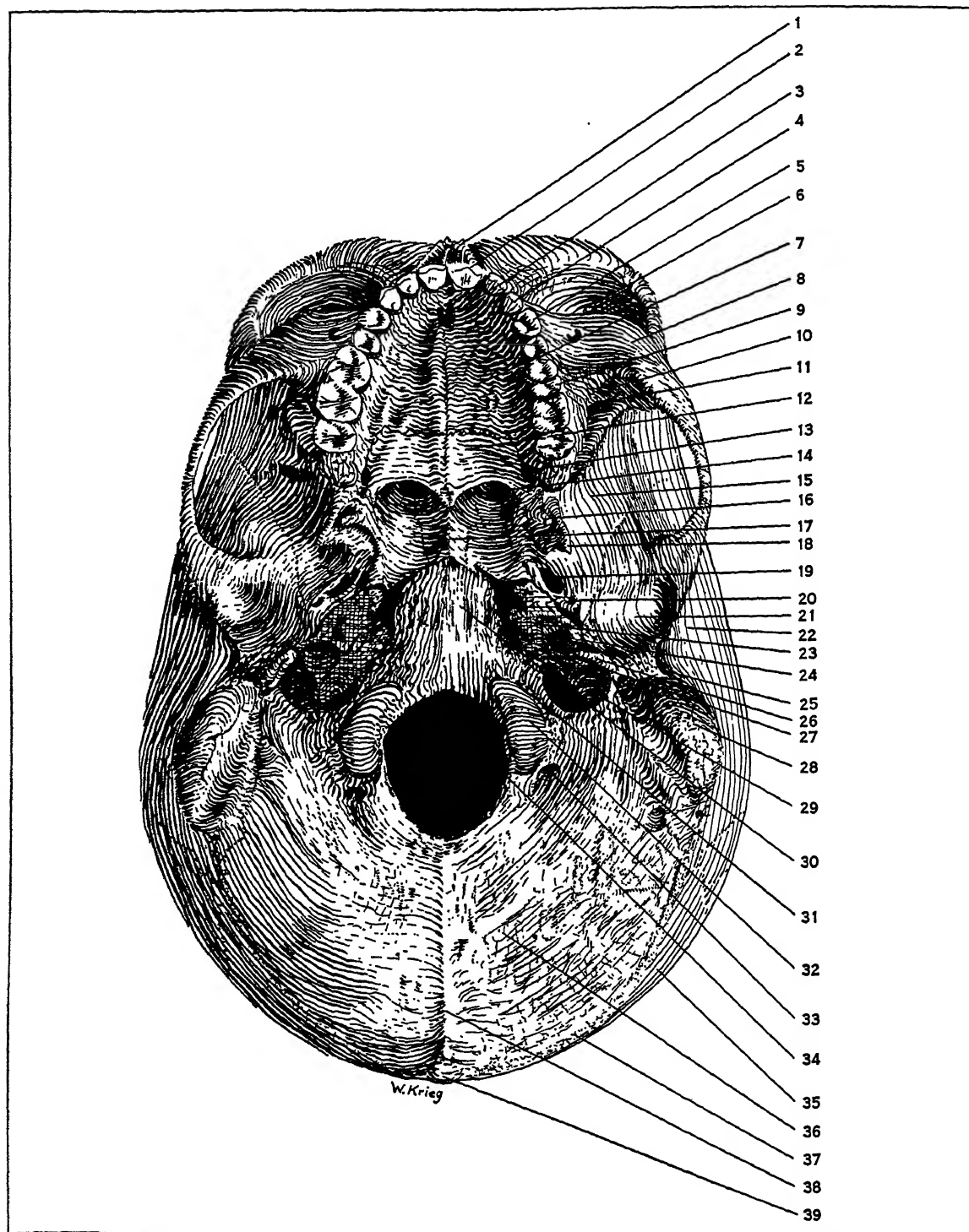


FIG. 2. SKULL VIEWED FROM BELOW, AFTER THE LOWER JAW HAS BEEN REMOVED

1, Nasal bone; 2, incisor teeth; 3, incisive canal; 4, canine tooth; 5, premolar teeth; 6, orbit; 7, palatine process of maxilla; 8, zygomatic bone; 9, molar teeth; 10, infratemporal fossa; 11, inferior orbital fissure; 12, palatine bone; 13, posterior palatine foramen; 14, choana (opening of nose into pharynx); 15, greater wing of sphenoid; 16, medial pterygoid process; 17, vomer; 18, lateral pterygoid process; 19, foramen ovale; 20, foramen spinosum; 21, mandibular fossa; 22, squama of temporal bone; 23, petrous portion of temporal bone; 24, carotid canal; 25, external opening of ear; 26, styloid process; 27, foramen lacerum (filled in by cartilage); 28, mastoid process; 29, foramen for jugular vein; 30, basilar part of occipital bone; 31, canal for hypoglossal cranial nerve; 32, condyle for articulation with atlas; 33, condyloid foramen; 34, foramen magnum, for spinal cord; 35, squamous plate of occipital bone; 36, nuchal plane of occipital, for neck muscles; 37, highest nuchal line; 38, medial nuchal line; 39, external occipital protuberance

bat, to continue the analogy. They are divided into medial and lateral plates (*M.P.*; *L.P.*).

The maxillae (*Mx.*) form the upper jaw, the greater portion of the upper part of the face, and the lateral wall of the nasal cavity. They contain air sinuses in their interior, enclose the roots of the upper teeth of either side, and roof the greater part of the mouth (*P.P.*).

The palatine bones (*P.B.*), L-shaped, lie behind the maxillae, and in series with them.

The zygomatic or cheek bones (*Z.*) have been referred to.

Several other bones assist in forming the nasal cavity, the ethmoidal bone forms its roof, and contains air sinuses. The vomer (*Fig. 2, Vo.*) forms the back part of the septum of the nose. The nasal bones (*N.B.*) form the bridge of the nose.

The lower jaw or mandible (*Fig. 1, Mn.*) supports the lower teeth and is the only movable portion of the skull. It is horseshoe-shaped when viewed from below, but when seen from the side is L-shaped. The vertical limb, or ramus, on either side terminates above in two projections. The temporal muscle inserts on the one in front (coronoid process, *C.P.*), while the one behind (condyloid process) is smooth and rounded to form a movable joint with a depression (*M.F.*) in the temporal bone.

If the skull as a whole be examined from various angles, it is seen that various bones contribute to the formation of certain markings. The orbit (*O.*), for example, a conical cavity to enclose the eye and its accessory structures, is formed by parts of seven bones. The various nerves and vessels enter the orbit through the superior and inferior orbital fissures, which together form a V-shaped deficiency at the back and floor of the orbit respectively (*I.O.*).

The temporal fossa (*T.F.*) is a depression above the zygomatic arch. It is occupied by the temporal muscle. The infratemporal fossa (*I.F.*) is a space below the zygomatic arch and internal to the ramus of the mandible, which is occupied by muscles of mastication.

Most of the sutures between the bones are designated by compounding the names of their constituent bones, but certain of them have merited special terms, viz. the coronal (*C.S.*), squamosal (*S.S.*), lambdoidal (*L.S.*), and sagittal sutures.

For skull injuries see NEUROSURGERY. See also SKELETON; BRAIN.

W. J. S. K.

SKULLCAP, the common name for a large genus (*Scutellaria*) of herbs and subshrubs of the mint family, often with showy flowers, some of which are planted as garden ornamentals. There are about 200 species of worldwide distribution, except South Africa; some 35 are found in North America. They are mostly annual or perennial spreading herbs or rarely erect subshrubs, bearing opposite leaves and numerous blue, scarlet, yellow or whitish flowers. The two-lipped calyx is somewhat helmet-shaped, whence the name skullcap. Representative American species are the mad-dog skullcap (*S. lateriflora*), found

across the continent and sparingly used in medicine; the blue skullcap (*S. galericulata*), with large blue flowers, of similar range and found also in the Old World, and the California skullcap (*S. californica*) of the Pacific coast.

SKULL IN ANTHROPOLOGY. There appear to be three fields in which the study of the skull is of value to anthropology: 1. human evolution, 2. racial differences, and 3. individual growth. A few anthropometric data on the skull in each of these three fields will be briefly discussed, and certain of the principal measurements used in obtaining such data will be noted.

The Neanderthal type of primitive human skull was characterized by a flat head, a low, receding forehead, a peculiar protruding occiput, heavy eyebrow ridges, a heavy but chinless jaw and, as intra-cranial casts indicated, a low type of brain—thus A. HRDLICKA. Still more primitive was the ape-man, *Pithecanthropus erectus*, who lived perhaps 100,000 years ago. He had a skull capacity of only 940 cc. That of the Papuans of New Guinea averages 1,236 cc. and that of the modern European 1,450 cc. Caution should be used, however, in attempting to estimate intelligence from the capacity of the skull, since there is only a low correlation between brain capacity and intelligence.

One of the varying characteristics of the form of the skull is expressed statistically as the CEPHALIC INDEX. This is the proportion of the breadth of the head to its length, as viewed from above, when the latter is held at 100. People with cephalic indices of 75.9 or under are generally classed as dolichocephalic or long-headed, those with indices of 76.0 to 80.9 as mesocephalic, or roundheaded, and those with indices of 81.0 and over as brachycephalic or broad-headed. As a whole, the Australian-African racial group is dolichocephalic, the Polynesian-European group mesocephalic, and the Asian-Amerindian group brachycephalic. In general, women have somewhat rounder heads than men.

Skulls may also be classified as prognathous (as with protruding jaw), pyramidal or elliptical. The first group is represented by the dolichocephalic Negroes of West Africa and the Negritos of Australia, the second by the Mongolians and Eskimo, with their broad, flat faces and narrow foreheads, and the third by the natives of western and southern Europe.

Prof. CLARK WISSLER has shown that each person, in his individual development, "starts with a relatively round head, ending in old age with a longer head." Also, he says, "the rounder the head in the adult stage, the greater the differences between the child and the adult. . . . This difference . . . seems to point to a close interrelation between the racial form of head and the growth curve."

It may be noted in conclusion how a few of the principal head measurements used in ANTHROPOMETRY are taken. According to international agreement, the length of the head is measured "from the glabella to the most prominent point of the occiput." The

breadth is "the maximum breadth of the skull above the supra-mastoid and zygomatic crests" (Hrdlicka). Head height, usually taken from the ears, is also frequently measured, as are also facial angle, height and width of face and of nose, and many other skull variables of anthropological interest. *See also* RACES OF MANKIND; CRANIOLOGY.

SKUNK (*Mephitis*), a large representative of the weasel family. The common skunk (*M. mephitis*)



weighs from 3 to 7 lbs. and is about the size of a cat. It is found in the eastern United States and Canada. The coat is black with a white stripe down the back, running into the tail, which is bushy and

always white-tipped. From 5 to 10 young are born each spring. Several species closely related to the common skunk, occur widely throughout the United States. If unmolested, the skunk is harmless, but it can, by means of powerful muscles in the anal region discharge from glands under its tail a foul-smelling, acrid liquid that is a powerful defense against man and animals. Skunks live on insects, frogs, mice, birds' eggs and, being nocturnal, often rob henhouses. For years skunk fur has been extremely popular. Skunk farming for fur production has been practiced but has not proved profitable.



SKUNK CABBAGE
Flowering spathe

SKUNK CABBAGE (*Symplocarpus foetidus*), a fleshy perennial of the arum family with a rank, garlic-like odor, called also polecat weed. It is found in swamps and wet soils from Nova Scotia to North

Carolina, westward to Minnesota and Iowa, and also in eastern Asia. The thick rootstock gives rise in very early spring to a partly underground, fleshy, purplish flowering-spathe. On a finger-like spadix within the spathe are borne minute flowers which often blossom while the snow is still on the ground. Later the large rhubarb-like leaves appear, followed by bright scarlet berries maturing in autumn. The somewhat similar western or yellow skunk cabbage (*Lysichiton camtschatensis*) occurs in the Pacific states and also in eastern Asia.

SKYE, an island of Scotland, the largest of the Inner Hebrides. It is separated from the mainland by the Strait of Loch and the Sound of Sleat. The length of the island is about 50 mi. and its area about 600 sq. mi. Skye has a jagged coast and the surface is generally mountainous. There is very little agriculture, only a few potatoes and turnips being produced. The island, however, is noted for its pastures and the sheep raised on them. The chief town is Portree, on the east coast. Est. pop. 1921, 11,000.

SKYLARK (*Alauda arvensis*), the common Old World species of lark, celebrated in prose and poetry for its exceptionally beautiful song. Scarcely larger than a sparrow, it is chiefly dark brown above, buff streaked with brown on the throat and breast, and creamy white below. It is found throughout most of Europe and Asia, where it frequents open places, especially cultivated areas, feeding upon seeds and insects. The slight nest, in which are laid three to five variously marked, grayish eggs, is usually placed in grain fields or tall grass. Several broods of young are raised each season. As a songbird the skylark rivals the nightingale, uttering its cheerful liquid notes usually soaring high in the air. It is a favorite cage-bird, enduring confinement well and singing freely in captivity. Because of its delightful song attempts have been made to introduce the skylark into the New World and it has become sparingly naturalized in Oregon and Long Island, New York. It is one of the most abundant of European birds and, when congregating in vast flocks at the approach of winter to migrate southward in search of food, it is netted in immense numbers for the market.

SKY WAVE, that part of a signal which departs from the ANTENNA of a RADIO TRANSMITTER in such a direction that it leaves the earth, or else returns to the earth only after refraction from the upper ionized layers of the ATMOSPHERE. *See also* GROUND WAVE; SKIP DISTANCE.

SLACKER, one who shirks, who avoids responsibility, who evades or attempts to evade the performance of any duty devolved upon him; particularly one who evades military duty. During the World War, the term came to be applied especially to those who evaded enrollment for military service, failed to respond to orders requiring them to report for incorporation in the Army or Navy or deserted after such incorporation. Before the end of the war, the term came to be one of reproach, disdain, contempt and scorn, applied with an imputation of disgrace or

ignominy to anyone who evaded the obligation to serve the country under arms or as a worker in an essential industry. After the close of the World War, lists of draft evaders and draft deserters were published in the Congressional Record. These lists were commonly referred to as slacker lists. *See also* DESERTER; SELECTIVE SERVICE. E. A. K.

SLAG, from blast furnaces, is used extensively in road building and as railroad ballast. There is possibility of utilizing it in ceramics. Some slag bricks are made from blast-furnace slag.

Open-hearth slag is mostly thrown away unless the phosphorus content (as calcium phosphate) is high, in which case it is used as a fertilizer. It can only be used when the pig iron in the charge is very high in phosphorus. Basic Bessemer slag high in calcium phosphate is also used extensively as fertilizer, particularly in France and Germany. Open-hearth slags high in manganese and iron are returned to the blast furnace, and the iron and about 65% of the manganese recovered. Acid open-hearth and Bessemer slags are thrown away. *See also* IRON BLAST FURNACE.

C. H. H.

SLANDER. *See* DEFAMATION.

SLASHING. *See* SIZING.

SLATE, a dense, homogenous rock of very fine texture, derived principally from the CLAYS and SHALES by METAMORPHISM. Very fine grained IGNEOUS ROCKS also may give rise to slates. Their distinguishing characteristic is the readiness with which they split into thin slabs. This cleavability is developed during metamorphism, the intense pressures to which the original rocks are subjected causing a rearrangement and flattening of the mineral grains, and some development of MICA. Slaty cleavage is not necessarily parallel with the bedding, in which it differs from the splitting of shales. The component minerals, visible only under the microscope, are normally QUARTZ, MICA, CHLORITE and carbonates. The KAOLIN and FELDSPAR of the original sediments have been converted into other minerals. Crystals of PYRITE, and veins and lumps of quartz or CALCITE are not infrequent. Slates are usually gray or black from organic matter, but iron oxides may produce red, yellow, purple and brown, and chlorite, green colors. The surface of slate is often smooth and silky. With increasing mica, mica slates pass into PHYLLITES. Slates with much argillaceous material in them are called clay slates.

Areas containing many metamorphic rocks are especially likely to show development of slates. The greater part of the domestic supply comes from the Appalachian district, and also from California, Arkansas and Minnesota. In England, and Wales, and elsewhere in Europe, they are well developed.

The principal use of slate is for roofing, table tops, switchboards, blackboards, stair treads, more massive pieces being made into sinks and tubs. *See also* PETROLOGY.

SLATER, JOHN FOX (1815-1884), American manufacturer and philanthropist, born in Slatersville,

R.I., Mar. 4, 1815. When 17, he started work in his father's woolen mill at Hopeville, Conn. At 25, he was the head of his father's mill and of a textile mill in Jewett City. In 1872, the ownership of a number of textile plants built by his father and uncle Samuel Slater, passed into his hands. In 1882, he established a fund of \$1,000,000 to provide educational facilities for the Southern negroes. Hampton (Va.) and Tuskegee (Ala.) institutes, as well as several other schools, were benefited by this fund, and, in 1892, the Slater Industrial School at Winston-Salem, N.C., was founded from it. Slater died in Norwich, Conn., May 7, 1884.

SLATER FUND. *See* JOHN F. SLATER FUND.

SLATE-WRITING, a phenomenon playing a large part in the spiritualistic seances in the later 19th century. Blank slates were placed in the cabinet or held under the table by the medium. When brought out they contained writing, often in response to questions, the source of which was credited to spirit agency. Often double-slates locked or tied, with a bit of slate-pencil between them, were found on opening to be covered with messages, and the scratching of the pencil was heard while waiting. That these were all conjuring tricks or specially prepared slates is abundantly proved. *See* SPIRITUALISM.

SLAUGHTER HOUSE, or packing house, is an establishment for the slaughtering of live stock and the conversion of the carcasses into dressed meat and meat by-products. It is usually planned so as to utilize the principle of gravity for movement of products. The animals are driven up an incline to the upper stories where they are slaughtered, and the carcasses are taken by elevator to a lower floor where they are strung up by the hind feet to a wheel on a track, and moved from room to room as they are bled, dressed, skinned, split in half and sent to the refrigerating room to be chilled. *See also* STOCK YARDS; PACKING PLANT.

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SLAUGHTERHOUSE CASE, 1873, a suit which led to a notable decision of the United States Supreme Court, construing for the first time the 14th Amendment. The carpet-bag legislature of Louisiana had granted to one corporation a monopoly of the slaughterhouse business within certain parishes of New Orleans, depriving about 1,000 persons of their accustomed occupation. The complainants charged abridgment of the life and property of citizens in violation of the 14th Amendment. Justice Samuel F. Miller, rendering decision on Apr. 14, 1873, stated that if such a right as freedom from monopoly existed, it was not a privilege of a citizen of the United States as distinguished from a citizen of a state; that the guarantees of the amendment extended only to rights which owed their existence to the Federal Government. Chief Justice Chase and three colleagues dissented. The radical Reconstructionists were greatly shocked by the decision that the essential effect of the 13th, 14th and 15th Amend-

ments was not to broaden the power of the general government, but to restrict the power of the states in specific matters, for this ruling left no hope of a judicial interpretation of the Reconstruction program which would fulfill the hopes of its sponsors. The extension of Federal power into spheres hitherto of state sovereignty was temporarily checked.

SLAVERY, the condition of ownership of one human being by another or by others. The degree of ownership varies so enormously between different times and different civilizations that it is impossible to give any detailed description of the institution which would not somewhere be in disharmony with the facts. At the outset two factors are to be found in slavery, the sexual and the economic. Sometimes the two are merged. Occasionally only women are slaves, but in an overwhelming number of cases slavery is primarily an economic institution.

Among primitive peoples of the past and in primitive tribes existing to-day some have and some have not slavery, and there seems to be no rule by which this is determined. Conquering tribes in the past, where they overpowered a settled population, almost always reduced the conquered to legal or actual slavery, but since this was possible only so long as the conquered were neither too numerous nor too complexly organized, other sources of slaves came into existence with increasing diversity of human society. Here began the slave trade, the procurement of slaves by wars undertaken for that purpose, or by purchase from tribes which themselves had undertaken such wars. Another source of slaves was, of course, domestic. In many societies men convicted of crime were enslaved, and in some men could sell themselves.

The institution was developed to its utmost logical extremity in the classical world, particularly at Rome. Under classical law the slave was not quite a human being, and though in Greece a master could not wilfully kill or torture his slaves, the Romans did not make even this exception. The number of slaves was enormous, often apparently exceeding 50% of the population, and the tasks given them constituted not only the bulk of the servile, agricultural and industrial work of Italy, but included much professional work, acting and teaching, and clerical work in business. Further a slave with a *pecunium* often engaged in extensive business operations for the account of his master, thus furnishing the latter with the equivalent of our limited liability corporation, since a master could not be sued for the debts of his slave. Slavery thus constituted a legal, and perhaps metaphysical, classification of men, but did not necessarily erect impassable social barriers.

With the decay of classical society in the late Empire and the rise of various levantine religions, slavery ceased to be the self-evident institution which even the most sensitive ethical philosophers of the Classical age had scarcely noticed, and gradually disappeared, not from the preachings of social or religious doc-

trines but spontaneously, and at times so rapidly that some of the emperors were forced to check manumission to prevent a too rapid disruption of society. In its place rose **SERFDOM**.

Slavery in Mohammedan society was a quite different institution. It was chiefly confined to infidels, but even they were neither numerous nor rightless, as at Rome, and a considerable element of Mohammedan slavery was sexual. Yet a slave who bore her master a son was usually set free and made one of his wives. Under the Turks developed the curious slavery of the **JANISSARIES**, the Sultan's guard, which was recruited from boys bought of the barbarians and the Christians. Eunuchs were typical of Mohammedan slavery, often rising to posts of great power and honor, and like the Janissaries, usually procured as children from the lands of the infidels.

Slavery as it existed in any previous civilization was little known in West-European or American society. It continued into the early Middle Ages but rapidly gave way to Serfdom, which in turn developed into a system of wage labor or of tenant farming. Slavery proper was introduced into the colonies in the period of colonial expansion and almost entirely applied to non-European peoples, chiefly Negro. Negro slavery was introduced into Spanish America in the 16th century to save the Indians, and then spread into the Portuguese, English and French colonies.

Objections to slavery became powerful at the end of the 18th century, led in England by **WILLIAM WILBERFORCE**. The northern states of the United States abolished it by the turn of the century, and in 1808 the slave trade was forbidden to English and American ships. By 1820 all the chief countries of Europe had prohibited the trade, and in 1842 a joint blockade of the African coast was agreed upon between the United States and Great Britain.

In the meantime the movement to free existing slaves made headway. In 1833 Parliament ended slavery in the British West Indies, paying the planters £20,000,000 compensation. The **CIVIL WAR** resulted in the abolition of slavery in the United States; in 1870 it was ended in Cuba, and in 1888 it was done away with in Brazil.

Slavery still exists in parts of Arabia and Africa but elsewhere in the world it has been officially abolished. Institutions somewhat resembling it do, however, still persist, as **PEONAGE** and contract labor, but their resemblance is less a matter of law than of actual working conditions.

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SLAVEY, or Etchareottine, a North American Indian tribe of the northern division of the Athapascan linguistic stock. They occupy that part of Canada west of Great Slave Lake and the Upper Mackenzie River, including the lower Liard River valley. They were a peaceable people continually harassed by the

Cree, who enslaved them; hence their name. The Cree drove them from their home of abundant game to Great Bear Lake. They are hunters and fishermen, loosely organized into nomadic bands.

SLAVIC, an INDO-EUROPEAN linguistic stock of the *satem*-group (see *SATEM-LANGUAGES*), so closely akin to **BALTIC** that the two are frequently classed together as Balto-Slavic. It is divided into three groups: East (Russian, Ukrainian and White Russian), South (Bulgarian, Serbo-Croatian and Slovenian), and West (Czecho-Slovak, Sorabian and Lechic, the latter comprising Polish, Kashubian, Slovincian and Polabian (see also separate articles on these subjects). The original home of all the Slavs was between the Carpathian Mountains and the Narew River, and between the Warthe and the Dnieper, i.e., approximately the territory of modern Poland. Because of the very conservative nature of its phonology and morphology (except in the verb, which has undergone much modification), and because of its retention, especially in Serbo-Croatian and Russian, of free-accent, Slavic ranks with **SANSKRIT**, **GREEK** and **BALTIC** as one of the most important sources for all study of Indo-European linguistics. The earliest literary documents of the group are translations in **OLD CHURCH SLAVIC**, dating from the second half of the 9th century. A. SE.

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SLAVIC, OLD CHURCH or **OLD BULGARIAN**, an extinct member of the South **SLAVIC** linguistic group of much scientific interest as presenting the oldest historically accessible data regarding the entire Slavic family of languages. It is characterized by change of INDO-EUROPEAN *a* to *o*, and *ō* to *a* (e.g., Old Church Slavic *darŭ*: Latin *dōnum*, "gift": Old Church Slavic *oŭci*: Latin, Gothic *atta* "father"), monophthongization of earlier diphthongs (e.g., Old Church Slavic *snġgŭ*: Gothic *snaiws*, "snow"), eight cases, and replacement of the old imperfect by a periphrastic formation with the Indo-European verb *es*, "be" (e.g., *znaachŭ* "I was knowing" = "I knew"). It was evidently a Bulgarian dialect spoken in the Macedonian area, and was the language in which, in 863, Bishops Cyril and Methodius, born at Salonica, brought their translation of the Gospel, at the invitation of Prince Rastislav, to Moravia, where a **CZECHO-SLOVAK** dialect was spoken. Subsequently banished from these regions, Slavic priests were kindly received by Boris, Czar of Bulgaria, and there the Old Church Slavic language and literature were especially cultivated, reaching their climax under Czar Symeon (893-927), with a revival in the later 10th and 11th centuries.

Old Church Slavic manuscripts are written in two different scripts, Glagolitic, the older, and Cyrillic, the younger, both derived from the Greek alphabet. The language was long the literary vehicle of the southern Slavs and the Russians, but was increasingly differen-

tiated after the 11th century, with the result that finally there were three varieties of Church Slavic: Middle Bulgarian, Serbo-Croatian and Russian.

A. SE.

BIBLIOGRAPHY.—W. Vondrák, *Altkirchenslavische Grammatik*, 2nd ed., 1912; A. Leskien, *Handbuch der altslavischen (altkirchenslavischen) Sprache*, 6th ed., 1921; N. van Wijk, *Geschichte der altkirchenslavischen Sprache*, 1931.

SLAVONIA, a province of northeastern Yugoslavia, embracing an area of about 16,000 sq. mi. and lying between the rivers Save, Drave and Danube. It is traversed by wooded slopes from the southeastern Alps, which here rise to heights of 4,000 feet above the sea. Along the rivers are fertile plains in which large quantities of corn and wheat are grown.

The people of Slavonia came to this region, formerly a part of the Byzantine empire and named Pannonia, in the 7th century. Their national history is bound up with that of Croatia, so that the two provinces are generally considered together. See **CROATIA**; **YUGOSLAVIA**.

SLAVOPHILES, a Russian school, at first of literary and historical, but later also of political thought, which originated in the 1830's. Deriving from the philosophy of Schelling and Hegel, Slavophilism favored distinctively Russian spirit and institutions and opposed the introduction of Western European social and intellectual influences. The most distinguished literary representatives of this school were the poets A. S. Khomyakov and F. I. Tyuchev and the novelist S. T. AKSAKOV. Apart from their romantic enthusiasm for the Russian Middle Ages, the Slavophiles evinced a pronounced sympathy for other Slavic peoples, particularly in the Balkans, and thus contributed to the rise of Pan-Slavism. Eventually Slavophilism itself also assumed a political tinge characterized by marked hostility to the Western Powers. The latter tendency was aggravated by foreign diplomatic intervention at the time of the Polish rebellion of 1863, and is best exemplified by the ultra-Slav and anti-German editorial policy of the *Moskovskiya Vedomosti*, or *Moscow Gazette*, under the direction of M. N. Katkov during the ferment in the Balkans after the Treaty of Berlin. Pan-Slavism, as an offshoot of Slavophilism, thus lies at the root of imperial Russian policy in dealing with Balkan problems up to the World War.

SLAVS, a branch of the Indo-Germanic stock and thus racially and linguistically akin to the Germans, to the classical races, and to the Indo-Iranian peoples. The Slavs make their first historical appearance in Europe about the beginning of the Christian era as the inhabitants of an area lying north of the Carpathians and extending from the upper Vistula to the middle course of the Dnieper. The expansion of the Slavs to the east, west, and south in the early centuries of our era is doubtless related to the general ferment among the northern barbarians of Celtic and Germanic stock which occurred at this epoch. By the 6th century, the Slavs had penetrated westward as far as the Elbe and, after crossing the Danube, had

touched both the Adriatic and the Aegean. Even at this early date, their tribal and linguistic differentiations were clearly marked. The Slavs west of the Oder rapidly yielded to German expansion; otherwise, apart from Russian colonization at the expense of interior Finnish tribes, the modern Slavs largely maintain their medieval conquests. Linguistically, they are divided into three groups: Western, including Czechish (Bohemian), Slovak, Polish, and certain minor dialectal survivals in German territory; Russian, with the main subdivisions Great-Russian and Ukrainian; and Southern, comprising Slovenian, Serbo-Croatian, and Bulgarian. Of all the Slavic peoples, those who have enjoyed the most constant contacts with western civilization are the Poles and the Czechs, whose intellectual progress has been correspondingly regular and rapid. Introduced to contemporary culture by the Byzantines in the 10th century, the Russians were subsequently cut off from the rest of Europe by the Tatar invasion and hegemony, and even after their emancipation in the 16th century, adopted western culture but slowly prior to the reforms of Peter the Great. Under the later Romanovs, education touched only the upper classes, so that the function of raising the standard of popular culture to contemporary levels has devolved entirely upon the Soviet régime. The Southern Slavs were for the most part deprived of the benefits of civilization by their subjection to the Turks, and thus quit the Middle Ages only as they threw off the Osmanic yoke. In literature, art, and music, the Slavic nations during the 19th century contributed to certain of the most brilliant and vital phases of occidental culture. The reestablishment of independent Slavic states like Poland and Czechoslovakia, together with the evolution of Soviet Russia, has now given this complex of kindred peoples an opportunity to play a prominent rôle in the modern world. S. H. C.

SLEEP, the daily quiescent period found throughout the entire range of plant and animal life. In human beings and the higher forms of animal life, the quiescence is accompanied by loss of consciousness. In sleep the pulse rate and breathing rate, blood pressure, muscular tension, metabolism and other vital phenomena are lower, but are not lower than in any period of voluntarily imposed quiescence without the loss of consciousness.

There is some indication that rebuilding processes take place, but the nature and extent of these are yet unknown. In addition, the conservation of the body through lessened activity is obvious.

It is not certain that blood is shunted from the brain to the internal organs in normal sleep; the drowsiness following a heavy meal may be due as much to tissue upbuilding processes as to anemia of the brain. The increase in lactic acid following exercise tends to produce an irritable restlessness rather than sleep. The role of habit in inducing human sleep is also marked. In the higher forms of life sleep is probably the result of a series of causes, although under exceptional circumstances one cause may be adequate to produce sleep.

Hypnotic and narcotic sleep are differentiated from normal sleep by the changes in vital phenomena given in the first paragraph. Loss of consciousness alone is not an adequate criterion of normal sleep.

Mental processes persist during sleep. The senses are active but dulled. The greatest dulling occurs about an hour and a half after going to sleep; the greatest sensitivity is regained after about four hours sleep, when noises, temperature, and light are most likely to disturb sleep. Thinking persists in the bizarre form of DREAMS, although under exceptional circumstances sound creative thinking appears to be possible in sleep.

The length of normal sleep varies from about twenty-three hours per day for the newborn infant to eight hours at the age of fifty; following fifty there is a slight increase in the sleep obtained when daytime and evening naps are included, although the period of night sleep may be shortened. There are individual variations from these amounts.

The average adult changes his sleeping position about every fifteen minutes. These changes of position, or what might be termed restlessness, are more marked during the winter months; evidence indicates that this is due not to temperature but to diminished sunshine and lowered calcium metabolism with resultant increased irritability of the body tissues.

The quality of sleep, or depth, is perhaps more important than length. Internal factors which improve the quality of sleep are emotional and muscular relaxation; the second is related to lactic acid and calcium metabolism, as well as to other obscure factors. External factors are: freedom from disturbing noises, darkness, and a comfortable bed and bed clothing. The daytime sleep of night workers suffers from noise and light.

Moderate disturbances of sleep are discussed in the section of INSOMNIA. See also FATIGUE. D. A. L.

SLEEPING SICKNESS, an affection of the brain complicating a number of infectious diseases, so termed because of the accompanying coma. It is not to be confused with trypanosomiasis or SLEEPING SICKNESS, AFRICAN. See ENCEPHALITIS LETHARGICA. See also COMA; CONVULSIONS.

SLEEPING SICKNESS, AFRICAN, scientifically called trypanosomiasis, an infection produced by a parasite known as the *Trypanosoma gambiense*. The infection is conveyed only by the bite of the Tsetse Fly, and is confined almost entirely to Africa.

In the first stage of the disease, when the trypanosomes are in the blood, the pulse is rapid, there is some mental dullness and the lymph glands are swollen. The spleen may be enlarged. This stage lasts from three months to three years.

During the second stage the organisms are in both the blood and cerebrospinal fluid. At this time, the facial expression is vacant, the speech slow and weak. There is tremor of the tongue, hands and feet. The fever is irregular.

The third stage, known as the stage of lethargy, lasts about eighteen months. There is a condition of

apathy. Wasting results from inefficient feeding. The temperature is very low, from 92° to 94° F. Death occurs in lethargy. The disease is invariably fatal if the third stage develops, but may be cured in other stages.

The diagnosis is made by discovering the presence of the parasites in the blood, or in material obtained by puncture from a lymph gland. W. I. F.

SLEEPLESSNESS. See **INSOMNIA**.

SLEEP WALKING AND TALKING. See **INSOMNIA**.

SLEET, a form of precipitation consisting of a mixture of very small hailstones and rain, or of snow and rain, or of wet snow alone. It occurs when the lowest layers of air are comparatively warm and cause the snow or hail particles descending from greater altitudes and colder air to melt slightly and to soften before they touch the ground.

SLEIGHT-OF-HAND, an art of manipulation by hand, similar to **LEGERDEMAIN**, necessitating study, nimbleness and much practice. The art was known to the magicians of Egypt, Chaldea, India and Rome, and to the medicine men of several American Indian tribes. It involves also a knowledge of laws governing optic illusions and attention, since the performer must be able to distract the audience's attention with his eyes, at the same time that he is shifting or concealing a particular object. Generally, the performer uses cards, coins and small animals, such as rabbits and mice, with which to perform his tricks.

The card trickster has a knowledge of sleight-of-hand. He can substitute, or withdraw, cards favorable to his hand, give the deck a false shuffle and conceal important cards on his person. Sleight-of-hand was highly developed by Houdin in the 19th century and more recently by Houdini.

SLEZSKÉ OSTRAVA (*Silesian Ostrau*), a Czechoslovak city across the river from **MORAVSKÁ OSTROVA** and to which it has been joined by incorporation into Greater Ostrava. Pop. 1930, about 25,000.

SLEZSKO. See **SILESIA**.

SLIAMNION, a North American Indian tribe living on Malaspina Inlet, Brit. Col., and speaking the Comox dialect of the Salish linguistic stock.

SLIDELL'S MISSION, a diplomatic episode preliminary to the MEXICAN WAR. President JAMES POLK despatched John Slidell of Louisiana, an able lawyer and Spanish scholar, to Mexico to endeavor to settle the issue of the Texas boundary and to purchase northern California; Slidell's instructions, however, stressed conciliation of the Mexicans as the primary object of the mission. Slidell landed at Vera Cruz, Nov. 30, 1845, and proceeded to the capital; the Mexican government, however, reflecting the prevailing hostility of the Mexicans toward the United States, refused to recognize his credentials as minister. Slidell lingered to treat with the succeeding administration in Mexico, but without success. Although the purpose of the mission was demonstrably peaceful, the official Mexican manifesto, July 26, 1846, listing the causes of war against the United States in-

cluded an attempt to induce Mexico to receive a resident minister before the United States had made amends for the annexation of Texas.

SLIDE RULE, one of the simplest forms of a **CALCULATING MACHINE**.

SLIGO, county town and seaport of County Sligo, Irish Free State, situated at the mouth of the Garvogue in Sligo Bay, about 134 mi. northwest of Dublin. The town contains the splendid remains of a Dominican Abbey founded in the 13th century. A 13th century castle and the town walls have left no trace. Sligo, with its fine harbor and extensive quays, has an important and varied export trade. Brewing and flour milling are of first importance in trade. Pop. 1926, 11,437.

SLIME MOLDS, a group of **FUNGI**, often brilliantly colored, usually saprophytic, but, in addition, having many of the characteristics of animals. They are, on this account often classed as animals rather than plants.

During much of its life a slime mould consists only of a naked mass of protoplasm, which is capable of slow amoeboid movements. This slow flowing of a living substance, wholly animal-like, also results in engulfing solid food materials, which are subsequently digested by the mold, another purely animal characteristic.

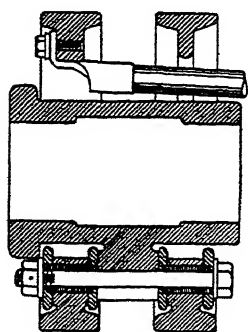
Slime molds live in the moist decayed layer of the forest floor and are classed as plants, in spite of their animal-like habits, because of their mode of reproduction. The slimy mass of protoplasm which constitutes the plant body, has many nuclei, but no general cell wall. During this stage it is partial to moisture, but flows toward drier sites when reproduction is near. Having arrived at the dry site, all movement stops, after which spores are developed. Upon the germination of these into amoeboid-like protoplasts, there follows a somewhat complicated series of **ALTERATION OF GENERATIONS**, resulting ultimately in a new slime mold. While most of these plants live in the woods, a few are the cause of destructive field-crop diseases, as the club-root of cabbage. N. T.

SLIMES, in ore treatment, a thin mud of finely ground ore and rock, called pulp. They unavoidably form in crushing and grinding operation, and are troublesome in **GRAVITY CONCENTRATION**, but not objectionable in the **FLOTATION PROCESS**. In cyaniding gold ores, some ores are slimed, to make the leaching solution more effective. See also **ORE TREATMENT**.

SLIPHER, VESTO MELVIN (1875-), American astronomer was born in Clinton County, Ind., Nov. 11, 1875. In 1901 he became astronomer of the Lowell Observatory, Flagstaff, Ariz., and director in 1926. He made studies of the planetary atmospheres and discovered the rapid rotation of many of the nebulae and the high velocities of some of the star clusters.

SLIP-RINGS, sometimes called collector ring or collectors, are insulated rings of conducting material mounted on the rotor of certain **ALTERNATING-CURRENT** generators and motors, and connected to the rotor

windings. They either collect the alternating current generated and, through stationary brushes which bear upon them, deliver it to an external circuit, or they take incoming current from the brushes and distribute



COLLECTOR ASSEMBLY CROSS-SECTION WITH TWO SLIP-RINGS

it to the rotor winding, as is the case in a synchronous converter. Sometimes brushes—connected to the field circuit or, as in the case of certain induction motors, to a starting resistor—bear on the slip-rings.

A collector with two slip-rings is illustrated in the figure. See also ELECTRIC GENERATOR; MOTOR, ELECTRIC.

SLIPS, a marine term. See PIER.

SLIVEN, a town in southern Bulgaria, on the railroad connecting Philippopolis with Burgas on the Black Sea. It is beautifully situated at the foot of the Balkan Mountains. Here is woven the celebrated Bulgarian cloth known as *shayah*, which is rough to the touch but of excellent texture and quality. Sliven also is noted for its wine and silk industries. Governed by Turkey for centuries, in 1878 Sliven became part of the Bulgarian state; but it still retains many Turkish inhabitants. The mosques, the covered bazaar and other Turkish remains give it an oriental appearance. Pop. 1931, 29,364.

SLOAN, JOHN (1871-), American painter and etcher, was born at Lock Haven, Pa., Aug. 2, 1871. Mainly self-taught, he was for a time staff artist on the *Philadelphia Press*, and later an instructor in the Art Students' League, Philadelphia. He moved to New York in 1904 and became known for his brilliant etchings of life in that city. Later he located in Santa Fé, Mexico, and devoted himself to Indian scenes. Sloan's works are in most of the important galleries in the United States.

SLOAN, MATHEW S. (1881-), public utilities magnate and banker, was born at Mobile, Ala., Sept. 5, 1881. Graduating from the Alabama Polytechnic Institute in 1901, he began work with the General Electric Company in Schenectady the following year. From 1906 to 1917 he was connected with public utilities in the South. In the latter year he became assistant to the vice president and general manager of the New York Edison Company and in 1928 was made president of that company. He is prominent in public utility and banking interests throughout the metropolitan area.

SLOANE, WILLIAM MILLIGAN (1850-1928), American educator and historian, was born in Richmond, O., Nov. 12, 1850. Shortly after graduating in 1868 at Columbia University, he went to Germany as private secretary to George Bancroft, minister to Berlin, and while there studied history under Mommsen and Draysen. In 1876 he was chosen professor of

history at Princeton where he remained 20 years, resigning in 1896 to become professor of history at Columbia. There he served another 20 years and retired in 1916 as professor emeritus. He is the author of *The Life of Napoleon Bonaparte*, *Party Government in the United States*, *The Balkans* and *The Powers and Aims of Western Democracy*. Sloane died in Princeton, N.J., Sept. 11, 1928.

SLOE, a very thorny, hard-wooded species of PLUM (*Prunus spinosa*), native to Europe and Asia, called also blackthorn. Numerous varieties are planted for their profuse early bloom, variegated foliage and ornamental fruits.

SLOOP. See YACHT.

SLOSSON, EDWIN EMERY (1865-1929), American scientist, was born at Albany, Kans., June 7, 1865. He studied at the universities of Kansas and Chicago, and from 1891 to 1903 was professor of chemistry at the university of Wyoming. For the next seventeen years he served as literary editor of *The Independent* and in 1920 became editor of the science service at Washington. In this connection he created popular interest in new scientific discoveries and projects through his writings in newspapers and magazines. His books include *Great American Universities*, *Creative Chemistry*, *Lessons in Einstein*, and *Snapshots of Science*. Slosson died at Washington, Oct. 15, 1929.

SLOTH, an edentate mammal of the family *Bradypodidae*. On structural grounds sloths are classified lower than American anteaters and the armadillos, from both of which they differ strikingly, especially in having an apelike form and a purely arboreal existence. These creatures, about the size of large monkeys, and clothed with thick gray hair, are known only in tropical America and spend their whole existence in trees. Their limbs are long and muscular, and end in long, curved, hook-like claws by which they suspend themselves beneath the branches, the leaves of which are their only food. Slowly moving from branch to branch, and clinging to one another's shaggy coats are almost the only action that sloth's hands and feet are called upon to perform, and it is hardly necessary for this animal to leave the tree in which it was born.



SLOTH

Two species of sloth are known: the ai or tardo (*Bradypus tridactylus*) having three toes on the fore feet; and the unau (*Choloepus didactylus*), with two front toes. The three-toed sloths are widely spread over the forested regions of Central and South America, while the two-toed are more limited in distribution. Both types contain several forms, the females of which produce one infant annually. Sloths hardly stir during the day, sleeping rolled into a ball not

easily visible among the foliage; whatever activity they display is at night. Concealment from their enemies is greatly increased by the growth on their fur of a minute alga, which gives their coats a greenish appearance conforming to the foliage amid which they repose. E. I.

SLOTTING MACHINES, machine tools similar to SHAPERS except that the ram is vertical instead of horizontal. They are used in machining locomotive frames and, in the smaller sizes, for machining, cutting and forming dies, and similar work in the tool room. They were formerly used for machining openings in locomotive connecting rods, but much of this is now done by milling. See also MACHINE TOOLS.

SLOUGH OF DESPOND, in Bunyan's PILGRIM'S PROGRESS, an irreclaimable miry pit seething with the filth and scum of wickedness, past which Christian with great difficulty made his way. The expression is frequently used in speaking of a period of great physical or spiritual depression.

SLOVAKIA, a province of Czechoslovakia, until 1918 part of Hungary, with an area of 18,895 sq. mi., embracing the larger part of the West Carpathian Mountains, most of which is watered by the Danube. There are four ranges of mountains in this district which also includes a part of the upper Hungarian plain. The climate is continental with hot summers and cold winters.

The Comenius University, founded in Bratislava in 1920 in place of the Hungarian University, heads the list of education institutions, which include several German and Magyar schools. Agriculture occupies 58.8% of the people. The farming methods are antiquated and the yield might be increased by one-third. In the mountains rye, oats, barley and potatoes are grown, and flax and hemp are still cultivated. In the fertile plain wheat, corn and sugar-beets predominate, together with tobacco, vegetables, fruit and hops. Stock raising is carried on in a primitive manner in the mountains. Industry, mostly in food products, has developed since 1900, but faces heavy competition from the more advanced provinces of Czechoslovakia. The peasants in the mountain districts are world famous for their beautiful hand made embroidery, weaving and wood carving. Although brown coal and graphite are present, mining in general has declined. There are numerous mineral springs. The majority of the inhabitants live in the thickly settled basins, while the mountains are almost uninhabited. Approximately seven-tenths of the people are Slovaks and Czechs numbering about 200,000, the remainder are Hungarians, Germans, Ruthenians, native Jews, Poles and others. Roman Catholics number about 70%, Protestants, 17%, Greek and Armenian Catholics, 6% and Jews 4%. Est. pop. 1929, 3,300,749.

SLOVENES, a South-Slavic people now affiliated with the Kingdom of Yugoslavia, and inhabiting the Krain and the Slavic sections of Carinthia and Styria. Primarily agricultural in occupation, they were early exposed to both Italian and German intellectual influences, and their culture centers around the uni-

versity at Laibach (Ljubljana). They total some two millions in number, and are represented in the United States by important emigrant groups in both Pittsburgh and Detroit.

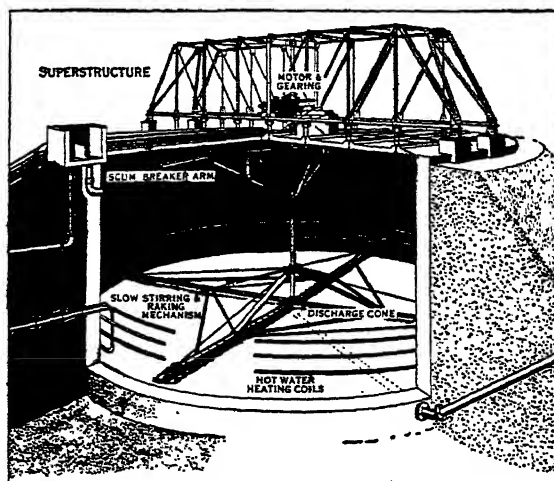
SLOVENIAN, a South SLAVIC language written in Latin characters and spoken by about 1,100,000 people in northwestern Yugoslavia (with Ljubljana as the center), by 500,000 in Italy (Gorizia, Gradisca, Trieste and northern Istria), and by 41,000 in Austria (southern Carinthia and Styria). It differs little from SERBO-CROATIAN. The ACCENT is free; long syllables show two different kinds of intonation; and nouns and verbs still possess the dual. The earliest literary record, the *Freising Texts* of the 11th century, consists of three different religious documents; but true literary Slovenian dates only from the 15th century, when it was particularly encouraged by the Reformation. A. SE.

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SLOVINCIAN, the native name of the Kashubians and the designation of the Lechic speech of the West SLAVIC linguistic group employed by a small Slavic population in the District of Stolp, south of Lake Leba, in Hinterpommern, Prussia. It is now spoken by only some 50 people as against about 200 in 1905. It is not an independent language, but merely the most western KASHUBIAN dialect, and is the connecting link between Kashubian and POLABIAN.

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SLUDGE DIGESTION, the purification of sewage following the primary effort of removing putres-



COURTESY THE DORR COMPANY

GAS COLLECTION TYPE OF SLUDGE DIGESTER

Sludge introduced into the tank is decomposed bacteriologically, forming gas or liquid. The gas is collected in a dome at the top of the tank and burned to heat the circulating water. After digestion the solids are withdrawn and dewatered on sludge drying beds

cible solid matter, which is carried out in SETTLING OR SEDIMENTATION TANKS: and by subsequent processes. The "sludge" or solid matter settled out, requires further treatment, or "digestion," which generally takes place during storage in separate tanks.

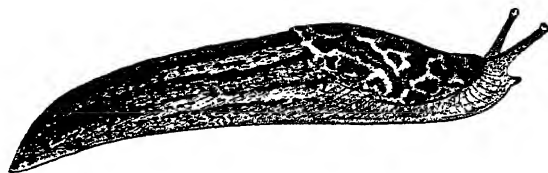
Satisfactory operation produces sludge with a high fertilizer value, which dries readily and can be disposed of without odor or other nuisance.

The nature of bacterial digestion seems to involve, in the early stage, production of certain acid products followed later by an alkaline reaction. A control of the pH value (*see* pH; *also* HYDROGEN ION CONCENTRATION), which must be kept near 7.3, is important to rapid and odorless operation, and is sometimes attained by chemicals but it can apparently be adjusted by controlling the rate of application of fresh solids, by continued slow agitation, and by maintaining an "optimum" temperature. Under careful control the process of digestion can produce a satisfactory sludge in a few weeks where formerly several months were considered necessary.

With proper manipulation, the production of gases of decomposition can be made uniform. Whereas in the past such gas has been the cause of serious operating difficulties—such as the "foaming" of tanks and the production of odors—it has now been shown that

Arionida), are generally called simply slugs, while the marine species are distinguished as sea slugs.

Common slugs may be from less than an inch to six inches in length, and black, gray, brown, yellow or

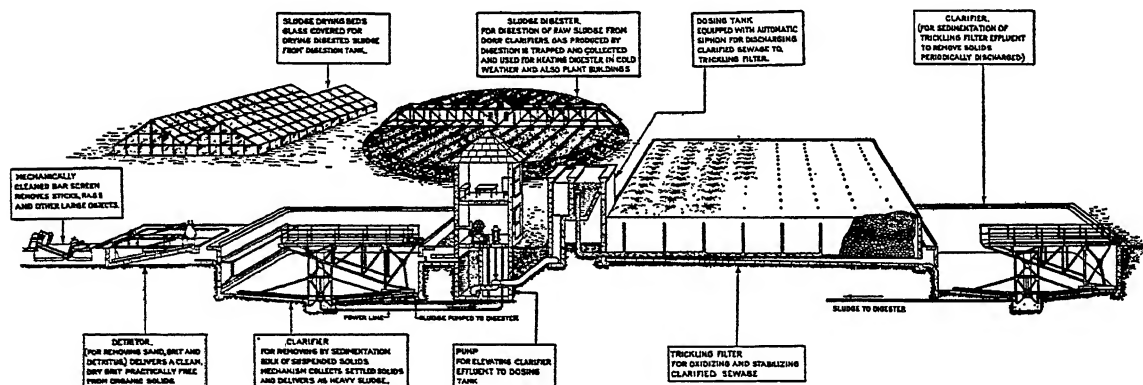


GREAT SLUG

(*Limax maximus*). Found in Europe, eastern North America and California

whitish in color. The head generally bears two pairs of horns or tentacles. The first pair are for feeling, while the second pair have eyes at their tips. Like most gastropods, slugs are hermaphrodites.

Usually they hide during the day, and emerge only at night. They live in forests, fields and gardens,



SEPARATE SLUDGE DIGESTION-TRICKLING FILTER SEWAGE TREATMENT PLANT

COURTESY THE DORR CO.

SEWAGE TREATMENT PLANT

Showing the steps in treatment of sewage introduced into the bar screen and carried through the detritor, clarifier, dosing tank, trickling filter, clarifier, sludge digester and sludge drying beds

this gas can be collected and under proper operation it may amount to nearly one cubic ft. per capita per day. The burning of only part of this gas may produce sufficient heat to maintain an optimum temperature in the *digester*.

The whole technique of sludge digestion is undergoing improvements which may permit sewage purification to be classed with well-managed manufacturing processes. *See also* SEWAGE TREATMENT.

W. W. H.

BIBLIOGRAPHY.—*Proceedings—American Society of Civil Engineers*, Vol. 94; *Proceedings—American Society of Municipal Engineers*, Vol. 36.

SLUG, the popular name for gastropod mollusks that have either no shell, or only a rudimentary one. The land-living forms, the most familiar of which belong to two pulmonate families (*Limacidae* and

where they often damage the plants, which they eat. Not all slugs are vegetarians, however. The snail slug, *Testacella*, which has a tiny, useless shell on its back, is carnivorous, and a fierce enemy of earthworms.

SMALL ARMS, that class of military weapons which are carried and operated by individual soldiers. They include the shoulder RIFLE, the REVOLVER and PISTOL, the SWORD, the LANCE, the BAYONET, the GRENADE and the MACHINE GUN.

All modern military rifles are breech-loading, loaded from magazines that contain five or more cartridges. Their bore diameters, or calibers, range from .25 to .315 in. and their barrel lengths from 25 to 32 in., their weight from 8 lbs. 8 oz. to 9 lbs. 3 oz. All breech mechanisms are operated on the bolt principle, the bolt being a hollow shaft containing the firing device and carrying on its exterior two or more lugs,

which turn with the bolt behind the projections on the receiver to lock the closed breech. The Mauser bolt action is used by more than 20 armies. All are loaded from clips carrying a full magazine charge, the cartridges being pushed from the clip by one motion of the thumb, and the clip being pushed off by the forward motion of the bolt.

The stock is made usually in one piece from well-seasoned walnut wood, shaped in a straight grip or pistol grip where the right hand grasps in rear of the receiver.

All rifles are fitted with two sights, one a narrow fixed blade set in a stud near the muzzle, and another, a folding leaf with a notch and peep provided with elevation and deflection scales and mechanisms set either on the barrel in front of the receiver or on the rear end of the receiver.

A few armies furnish to their mounted troops a short model of the service rifle, called a CARBINE. It usually fires the same ammunition as the service rifle.

Competitive tests have been held in several armies with a view to selecting for service use a semi-automatic shoulder rifle in the service caliber or a smaller caliber. Several types have passed reasonable tests. Another war will see such rifles gradually replacing the standard service magazine shoulder rifle. The advantages to be gained are the firing of eight or ten aimed shots without distraction of the firer from his target, and more fire power from a given organization.

The sword has held its place as the personal arm of the gentleman over many centuries. It symbolized knighthood and dignity. It is still worn by officers and noncommissioned officers as a symbol of rank on formal occasions, but has lost its importance as an arm of dismounted troops. For shock action by mounted troops it remains an important part of the trooper's equipment. In the cavalry SABER it has become almost entirely a straight thrusting weapon.

Since the 16th century the bayonet has replaced the lance or spear in the hands of infantry. The sword bayonet is now used in all armies. It is a double-edged dagger type, carried in a scabbard at the soldier's waist belt, 18 to 24 in. long, weighing 16 to 18 oz., manufactured of high quality forged steel, ground and polished. A handle and guard are provided for use independent of the rifle, but fitted with attachments to quickly and securely lock on the muzzle of the rifle.

The revolver or pistol remains the military personal weapon for quick use at close quarters. Nearly all armies use a double action, six chamber, .45 in. caliber service revolver, but the self-loading or semi-automatic pistol with magazine feed similar to the standard .45 caliber pistol in the U. S. Army is finding favor in other services. The standard hand grenade and rifle grenade are close range weapons of all troops. Gas grenades, smoke grenades and signal grenades supplement the service standard types.

The enormous fire power of the machine gun in its many types and sizes has fixed its place in all

armies. Many improvements have been made in all types to secure lightness, greater accuracy, higher rates of fire and greater control of the rate, more reliability, simpler cooling methods, greater resistance to wear, greater safety in operation, more economical manufacture. The service types in all armies fire the same ammunition as the service rifles. At the end of the World War, the principal fire power of the dismounted units came from their automatic weapons. The tendency of all armies is to adapt the automatic arms to every service, making special designs to fit the particular needs of each. In addition, the automatic principle is being extended to higher calibers. A .50 in. caliber is now standard for antiaircraft use in several armies, including the U. S. Army. The 37-mm. gun is also being developed for antitank and antiaircraft use as an automatic weapon. C. G. M.

BIBLIOGRAPHY.—C. W. Sawyer, *Firearms in American History*; British War Office, *Textbook of Small Arms*.

SMALLPOX, or **VARIOLA**, in ancient writings, is confused with other skin eruptions, such as measles, syphilis (great pox), and chickenpox. Rhazes, about 900 A.D., wrote the first good description of the disease.

Before the era of vaccination smallpox was regarded as inevitable. John Haygarth, in 1778, first urged suitable isolation of smallpox patients. The London Smallpox Hospital was founded not primarily for isolation, but to provide a place where persons could be inoculated with smallpox and thus have much milder attacks of the disease. One attack of smallpox has always given nearly uniform protection against a second attack. **VACCINATION**, dating its introduction by EDWARD JENNER in 1798, has done away with the practice of inoculation.

Thus, in the present day, the disastrous epidemics of smallpox are almost unknown, and the enormous number and virulence of cases, previously taken almost as a matter of course, have been reduced to a minimum in the vaccinated areas.

Smallpox commonly begins about twelve days after exposure, direct or indirect, to another case. There are at first general aches and symptoms of fever, which usually subside in about three days, when the eruption appears on the skin. This eruption consists of red papules, which in a few days become pustules and then scabs. In mild cases there may be only a few "pocks"; in other cases, parts of the body, especially the face and arms, may be very thickly covered. Rarely, severe cases may die with hemorrhages in the skin or elsewhere before the eruption appears, but death does not usually take place until two weeks or more after onset. (See also FINSSEN, NIELS RYBERG.)

Some outbreaks, including most of those which have occurred in the United States in recent years, have been comparatively mild, less than 1% dying among those attacked. About 30,000 cases per year are reported in the United States, with only a few hundred deaths. The greater part of these cases occur in communities where the population is less regularly vaccinated. From time to time more severe out-

breaks occur, the fatality being 20% or more among the unvaccinated.

Vaccination has to be more recent to protect completely against attack during these severe outbreaks. Even an old vaccination may make an attack milder, though the general mildness of the cases in the United States at present is not due entirely to vaccination. More sanitary habits and living conditions, as well as isolation of the cases, have contributed to the diminished prevalence of smallpox, but the great improvement in the control of the disease has been due to the use of *vaccination*. See also CHILDREN, DISEASES OF: Infectious Diseases. J. P. L.

SMALTITE, an important ore of cobalt which consists of the arsenide of cobalt. It is tin-white in color, sometimes tinged with pink, and with a metallic appearance. Smaltite crystallizes in the ISOMETRIC SYSTEM. It is often associated with arsenopyrite, and the arsenic sulphide of cobalt, called cobaltite, also a cobalt ore. It is mined in Norway, Germany, and at Cobalt, Ont.

SMARTWEED, the name given to various herbs of the knotweed genus (*Polygonum*) having an acrid, peppery juice, especially to the common smartweed or water pepper (*P. Hydropiper*), native to Europe and Asia and very widely naturalized in North America. The mild water pepper (*P. hydropiperoides*), indigenous to North America, is found across the continent.

SMELL, the olfactory sense. Its end organ consists of true nerve endings embedded in the mucous membrane lining of the upper part of the nasal passage. The receptors are susceptible to stimuli principally of a gaseous nature. Smell is closely associated with TASTE, though olfactory sensations are not so easily separated into their elementary qualities as are those of taste. In fact there is no universal agreement as to the number of elementary olfactory sensations. The different types are usually distinguished by reference to the stimulating object. Such a convenient classification is that of Zwaardemaker, as given by Angell:

<i>Kinds of odor</i>	<i>Provoked by</i>
1. Ethereal	fruit
2. Aromatic ..	camphor, spice
3. Fragrant	flowers
4. Ambrosiac	musk
5. Alliaceous	garlic, chlorine
6. Empyreumatic ...	burning of tobacco, burnt toast
7. Hircine	cheese
8. Virulent	opium
9. Nauseous	decaying animal matter

From the above list it will be seen that olfactory sensations are not only varied in their kind but are produced by varied types of substances. See also NOSE.

SMELLING SALTS. See AMMONIUM COMPOUNDS.

SMELT, a group of fishes (*Osmerus*) of a separate family (*Argentiniidae*), related to the salmon which they resemble but in reduced size. The most common American smelt (*O. mordax*) is found on the Atlantic coast from Maine to Virginia and in many

lakes, especially Champlain and Memphremagog, where it has become landlocked. A wide mouth and an elongate, compressed body from 8 to 12 in. long, green above with silver sides, characterize the smelt. From the earliest colonial times the smelt has been considered an excellent food fish. In the winter spawning season these fish frequent bays and inlets in great numbers, where they are caught with nets and lines. A European smelt (*O. eperlanus*) is abundant on the Atlantic coast from Norway to England and others (*O. thaleichthys* and *O. japonicus*) occur on the eastern and western Pacific coasts. A lake herring, or ciscoe (*Leucichthys osmeriformis*) of certain New York lakes, resembles the smelt somewhat and is called by that name.

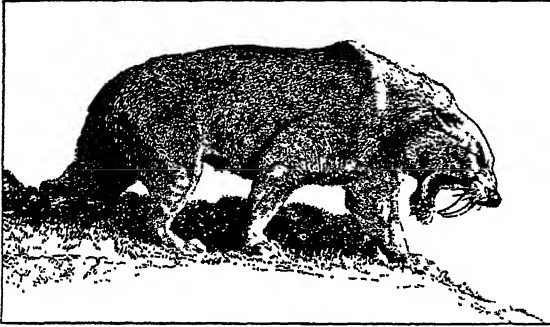
In 1929 the total commercial catch of smelt in United States waters, taken chiefly along the New England and Pacific coasts, amounted to 3,362,000 lbs., with a value of \$301,000.

SMETANA, FRIEDRICH (1824-84), Bohemian composer, was born at Leitomischl, Mar. 2, 1824. He was largely self-taught as a youth, later studying the pianoforte and theory with Josef Proksch. Aided by FRANZ LISZT, he opened a pianoforte school in 1848. In 1856 he was appointed director of the Gothenburg Philharmonic Society, and in 1861 threw himself heartily into the movement to found a national theater at Prague. With the production of *The Bartered Bride* in 1866 he became a national figure. While he composed several more operas, among them *Hubicka* and *Certova stena*, *The Bartered Bride* remained his only substantial success, although some of his music-dramas are currently produced in central Europe. Deafness overtook him in 1874 and he became insane shortly before his death. It was during his last decade that he composed his E minor quartet. In addition to the operas, two other string quartets, a symphony, the six tone-poems collectively entitled *Ma Vlast*, a fantasy for violin and orchestra, numerous part-songs, and a set of dances for the pianoforte are among his chief compositions which, with those of his compatriot DVORÁK, are considered the most important in Bohemian music. He died at Prague, May 12, 1884.

SMILAX, a large genus of tendril-bearing, more or less climbing plants of the lily family. There are 210 species, natives chiefly of tropical and subtropical regions; about 25 are found in North America. The dried roots of several tropical species yield SASSAPARILLA. They are chiefly vines, with woody or herbaceous, often prickly stems, bearing netted-veined leaves, small greenish flowers in axillary umbels, and numerous bluish-black or red berries. Representative American species are the GREENBRIER (*S. rotundifolia*), of the eastern states; the bristly greenbrier (*S. Bonanox*), of the southern states, and the western greenbrier (*S. californica*), of California and Oregon. The smilax of the florists is a species of ASPARAGUS.

SMILODON, an extinct genus of the cat family, comprising the largest and fiercest of the saber-toothed tigers. Of these the gigantic South American species

(*S. neogaeus*) was the most formidable of known carnivores, living or fossil. As large as a grizzly bear, it was more powerfully built, with limbs shorter, but more massive, than those of any living lion or tiger. Its chief weapons were the deadly "sabers," a pair of enormously developed sharp-edged upper canine teeth or fangs projecting 6 in. or more beyond the jaw. With these curved, dagger-like tusks, the



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GIANT SABER-TOOTHED TIGER OF SOUTH AMERICA
From a painting by Charles R. Knight

animal stabbed, rather than tore its prey which almost certainly included the mastodon, the mammoth, and the great ground sloth.

More than 1,000 skulls of a smaller saber-tooth (*S. californicus*) confined to North America, were found in the famous tar-pits at Rancho La Brea, near Los Angeles. Attracted by the outcries of mired animals, these came to prey and were themselves entrapped in the sticky tar.

SMITH, ADAM (1723-90), political economist, was born at Kirkcaldy, Fifeshire, Scotland, June 5, 1723. He went to the University of Glasgow and then to Oxford where he remained until 1747. He returned to Glasgow as professor of logic, meanwhile contributing articles on economics to the *Edinburgh Review*. In 1763-66 he toured the Continent as the companion of the young duke of Buccleugh, and was engaged on his great work, the *Inquiry into the Nature and Causes of the Wealth of Nations*, a classic work in the field of political economy. Its publication in 1776 brought the author wide renown and the acquaintance and admiration of such men as Pitt, Gibbon, Burke and Wilberforce. He received the honor in 1787 of election as lord rector of the University of Glasgow. He died at Edinburgh, July 17, 1790.

SMITH, ALFRED EMANUEL (1873-), American legislator and governor, was born in New York City, Dec. 30, 1873, the son of an Irish truckman. He was educated at St. James School in the "Old Fourth Ward," and left school after the eighth grade, in order to help support his mother and sister. He sold newspapers, was a "checker" in the Fulton Fish Market and was also a shipping clerk. He joined the local Democratic political club and worked for the success of the party in his home district. His likable personality and speaking ability soon brought him

local prominence. In 1895, he received, as political patronage, an appointment as an investigator in the office of the Municipal Commissioner of Jurors.

Beginning in 1903, Smith was for 12 successive years elected to the State assembly. In 1911 he was majority leader and chairman of the committee on ways and means and in 1913 he was speaker of the assembly. As a member of the State Constitutional Convention in 1915 his mastery of the details of state government won warm praise from Democrats and Republicans alike. He was sheriff of New York County, 1915-1917, and the latter year was elected president of the city board of aldermen. He resigned in 1918 to become the successful Democratic candidate for governor of the state. He served from 1919-21, was swept out of office by the Republican "landslide" of 1920, but was reelected in 1922, 1924 and 1926, serving from 1923 to 1929.

Smith's first term, following immediately the World War, presented a complex problem of reconstruction for the state. Smith appointed a non-partisan Reconstruction Committee which drafted a plan of legislative action, which included a state income tax and a reorganization of the state government. During his second term as governor, Smith was handicapped in his proposed policies by the opposition of a Republican controlled assembly. Partisan obstructionism continued during his third and fourth terms, but Smith by appealing to public opinion, and by emphasizing the non-partisan benefits which would result from his proposals successfully installed a large part of his program. Substantial sums were expended for the improvement of state hospitals and other state institutions, the conditions of state parks were bettered, definite plans, with the necessary funds, provided for the elimination of railway grade-crossings throughout the state; and the state government was thoroughly reorganized in 1927 in accordance with a scheme formulated by an unofficial commission, which had been headed by CHARLES E. HUGHES, a Republican. Smith was especially energetic in the promotion of social legislation which would improve the working and living conditions of men, women and children. He opposed the development by private interests of the state's natural resources of water power but urged such development by the state and the subsequent leasing of it to private concerns.

In 1924, Governor Smith and WILLIAM GIBBS McADOO were the leading candidates for the Democratic presidential nomination. At the Convention in New York City, they unyieldingly prevented the obtaining of the necessary two-thirds vote by one another, the nomination after more than a hundred ballots going to JOHN W. DAVIS as a compromise candidate. Smith's candidacy gained such irresistible strength before the National Convention of 1928 that he was nominated for the presidency on the first ballot. Various explanations of readily apparent factors were advanced for his overwhelming defeat by HERBERT HOOVER, the Republican candidate, —his Roman Catholic religion, his opposition to na-

tional prohibition, and his connection with Tammany Hall. These reasons, singly or combined, might explain the defection from the Democratic Party of many states of the Solid South but elsewhere Smith's defeat was no more emphatic than was Davis's by CALVIN COOLIDGE, four years earlier. In 1930, Smith became president of the corporation which erected the EMPIRE STATE BUILDING, New York City. He was defeated for the Democratic nomination in 1932 by FRANKLIN D. ROOSEVELT.

SMITH, ALFRED HOLLAND (1863-1924), American railway official, born in Cleveland, O., Apr. 26, 1863. He began his railroad career in 1879, when he secured employment as a messenger boy with the Lake Shore & Michigan Southern Railway. In 1890 he was made superintendent of the Kalamazoo division of that road, and, in 1901-02, he held the office of general superintendent. He then went with the New York Central and Hudson River Railroad, becoming president of that system and its subsidiary roads in 1914. During the World War he served as assistant director general of railroads. He died in New York City, Mar. 8, 1924.

SMITH, BENJAMIN ELI (1857-1913), American editor, was born at Beirut, Syria, Feb. 7, 1857, and graduated from Amherst College in 1877. He became managing editor of the *Century Dictionary*, 1889-1891, and editor in 1894; he subsequently edited other dictionaries, supplements and atlases. Smith also translated Schwegler's *History of Philosophy*, 1879, Cicero's *De Amicitia*, and *Laelius*, 1897, and edited, among other works, Franklin's *Poor Richard's Almanac*, 1895, and selections from Pascal, 1902. He died Feb. 25, 1913.

SMITH, DAVID EUGENE (1860-), American mathematician and educator, was born at Cortland, N.Y., Jan. 21, 1860. He graduated from Syracuse University in 1881 and received his Ph.D. degree there six years later. From 1884-91 he taught at the Cortland State Normal School and from 1891-98 was master of pedagogics in the Michigan State Normal College. The following four years he was principal of the Brockport Normal School. In 1901 he went to Teachers College, Columbia University, where he remained until 1926 when he retired from active teaching. His chief contributions have been in the teaching and the history of mathematics. He is the author of numerous texts and professional books on the subject of mathematics. From 1902-20 he was the editor of the *Bulletin of the American Mathematical Association*. Smith was also the editor of De Morgan's *Budget of Paradoxes*, 1915, and editor of mathematics for *The National Encyclopedia*, 1932.

SMITH, FRANCIS HOPKINSON (1838-1915), American engineer, author and artist, was born in Baltimore, Md., Oct. 23, 1838. He became a mechanical engineer and constructed the breakwaters at Block Island and at Tompkinsville, S.I., the Race Rock Lighthouse at New London, Conn., and the foundations for the Statue of Liberty in New York harbor. As an artist in charcoal and in watercolor he has been

represented in American galleries, and he is the author of *Colonel Carter of Cartersville*, 1891, *The Romance of an Old Fashioned Man*, 1907, and *The Arm Chair at the Inn*, 1912. He died in New York City, Apr. 8, 1915.

SMITH, GOLDWIN (1824-1910), British historian and author, was born at Reading, Aug. 13, 1824. He attended Eton and Magdalen College, Oxford. From 1858-66 he taught modern history at Oxford, and in 1868 went to the United States to teach constitutional history at Cornell University. He went to Canada in 1871 where he created a furore in 1891 by declaring that annexation of the Dominion by the United States was "written in the stars." His works include *Irish History and Irish Character*, 1861, *The Empire*, 1863, *Civil War in America*, 1866, and *Short History of England*, 1869. Smith died at Toronto, June 7, 1910.

SMITH, CAPTAIN JOHN (1580-1631), explorer and colonist, was born in Lincolnshire, England in 1580. After an adventurous career as soldier of fortune on the continent, he sailed for Virginia on Dec. 19, 1606 with the expedition of three ships sent out by the London Company. Quarrels on shipboard resulted in his being made a prisoner, but he was accorded a trial at the new settlement of Jamestown, was released and soon rose to a position of leadership. He later went on an exploring expedition up the Chickahominy River where he was captured by Indians. His captors were on the point of clubbing their captive to death when the chief's favorite daughter, the famous Pocahontas, seized the victim's head in her arms, at the same time thrusting her own between the clubs and the victim. Her courageous intercession, according to tradition, ensured Smith his life. He returned to Jamestown, and worked vigorously for the prosperity of the settlement, being appointed president of the Council in September 1608. But an expedition sent out from England refused to acknowledge his authority and he was sent home in October 1609. Captain Smith never returned to Virginia, but later explored Canada and New England. He died in London, June 21, 1631.

SMITH, JOSEPH (1805-44), founder of MORMONISM, was born at Sharon, Vt., on Dec. 23, 1805. His parents having settled near Palmyra, N.Y., in 1815, Smith declared that through a revealing vision he had located the gold plates for the *Book of Mormon* which he published in 1830. He asserted further that he had found certain optical instruments for translating the symbols of the book; the translated matter he dictated to amanuenses through a screen. Having printed the *Book of Mormon*, he organized a church, claimed to be a prophet of God, and named his sect Church of Jesus Christ of the Latter Day Saints. During the years 1831-44, in which his cult spread rather rapidly, Smith found trouble wherever he attempted to make a religious settlement, and in 1844 was arrested and imprisoned at Carthage, Ill. An irate mob broke into the prison there on June 27, 1844 and killed him. See also BRIGHAM YOUNG.

SMITH, SAMUEL FRANCIS (1808-95), American writer and minister, was born at Boston, Mass., Oct. 21, 1808. After being graduated from Harvard and Andover Theological Seminary he became professor of modern languages at Waterville College, afterwards Colby. Later he edited various Baptist publications. His fame, however, rests mainly upon his hymns, among which are the national lyric, *My Country, 'Tis of Thee* and *The Morning Light is Breaking*. Besides hymns he published several religious works, including *Missionary Sketches*. He died at Boston, Nov. 16, 1895.

SMITH, SYDNEY (1771-1845), English writer and churchman, was born at Woodford, Essex, June 3, 1771. He was educated at Oxford, where he was ordained. In 1798 he went to Edinburgh, where he preached and helped to establish *The Edinburgh Review*, in which his brilliant articles appeared for 25 years. He went to London in 1803 and became successively vicar of Foston-le-Clay, prebendary at Bristol Cathedral, and canon at St. Paul's. His *Peter Plymley Letters* were written in behalf of Catholic emancipation. Because of their wit and brilliance his writings have been compared to those of SWIFT; they appeared, in four volumes, 1839-40. Smith died at London, Feb. 22, 1845.

SMITH, WILLIAM (1769-1839), British geologist and engineer, was born at Churchill, Oxfordshire, Mar. 22, 1769. After training himself in civil engineering, he built canals, surveyed for mine shafts and worked on problems of water-supply and drainage. Smith had become interested in fossils and was the first to realize that underlying formations affect the nature of the top-soil. He also announced that geologic strata might be arranged in a chronological order, and showed that the presence of similar fossils in different localities was an indication that the rocks in which they were found belonged to the same geologic age. The Geological Society of London awarded him the Wollaston medal when he was past sixty. He published a geological map of England that has taken its place as one of the great classics of geological cartography. He died at Northampton, Aug. 28, 1839. See also GEOLOGY; STRATIGRAPHY.

SMITH, SIR WILLIAM ROBERTSON (1846-94), Scottish philologist, was born at Keig in Aberdeenshire, Nov. 8, 1846. He studied at Aberdeen University, at New College, Edinburgh, and at Bonn and Göttingen. He became professor of Oriental languages and exegesis of the Old Testament in the Free Church College, Aberdeen, in 1870. He was removed from his chair in 1881 because of his views regarding some parts of the Old Testament. In 1883 he was appointed professor of Arabic at Cambridge. Among his works are *The Old Testament in the Jewish Church*, 1881, *The Prophets of Israel*, 1882, and *Kinship and Marriage in Early Arabia*, 1885. He died at Cambridge, Mar. 31, 1894.

SMITH COLLEGE, the largest institution for higher education for women in America, at Northampton, Mass., was founded by Sophia Smith. It

was incorporated and chartered by the State of Massachusetts in 1871. Of special interest is the arrangement whereby the students may spend their junior year in France, Spain, Italy or Germany working under the guidance of the Smith College faculty. The art and music courses have always played an important part in the curriculum, and a Summer School of Music is held each year. Smith grants Ph.D. degrees. The productive funds amounted in 1931 to \$6,293,557. Approximately \$100,000 are given annually for scholarships. The library contained 191,900 volumes. In 1931-32 there were 1,926 students and a faculty of 225, headed by WILLIAM ALLAN NEILSON.

SMITH'S FALLS, a town and outpost of Lanark Co., Ontario, Canada, situated on the Rideau River and Canal, near Big Rideau Lake, about 40 mi. southwest of Ottawa with which city there is regular steamboat communication. Large agricultural implement plants are of primary industrial importance, and there also are saw, shingle and planing mills, as well as a malleable casting plant and brick works. Both the Canadian Pacific and Canadian National railroads serve the town which is a divisional point for the Canadian Pacific Railroad. Pop. 1921, 6,790; 1931, 7,108.

SMITHSON, JAMES (1765-1829), English chemist, was born at Weston, Super Mare, Somerset, in 1765, his mother being the widow James Macie, whence he received the name James Lewis Macie. Around 1800, however, he took the name Smithson which was the family name of the first duke of Northumberland, his father. He studied at Oxford, and although he did not contribute much original work, his thorough knowledge and critical ability made him rank equal to the foremost scientists of his day, and procured his election to the Royal Society in 1787. He died in Genoa, June 27, 1829, and after the death without heirs, of his nephew, who was his sole legatee, another clause of his will assigned his estate to the Government of the United States, for the founding of the Smithsonian Institution.

SMITHSONIAN INSTITUTION. This unique fountain of knowledge in the city of Washington originated in a bequest to the United States of \$550,000 by James Smithson, an English scientist. In 1846 Congress established the Institution under the guidance of a Board of Regents, whose secretary, Professor Joseph Henry, was made its executive, and the present picturesque building in the Mall was soon thereafter erected. The purpose of the fund (since augmented) was, in Smithson's phrase, "the increase and diffusion of knowledge among men," an ideal strictly adhered to. Henry, a physicist, began researches in that direction, one of which was the germ of the present U.S. Weather Bureau. The Wilkes U.S. Exploring Expedition and various western surveys had accumulated many interesting "specimens" stored in the old Patent Office. These were taken by the Institution and classified, forming the nucleus of the National Museum.

Scientific interest in the prehistory, customs, and languages of our Indians led to the foundation within the Institution of a Bureau of American Ethnology, which soon became, and still is, of great importance. In 1890 the Congress bought land and appropriated funds to the Institution to found the National Zoological Park, now among the foremost of such establishments. In 1891, when Langley was Secretary, the Astrophysical Observatory was added to its care. The principal aim of this observatory is the exact measurement of the radiation of the sun, which it has shown to be variable. From its researches has arisen great promise of long-range weather forecasting. A large corps of "collaborators" in this country and abroad contributes in various ways to further the purpose and activities of this productive and independent agency.

The Institution from the first has encouraged and financed earnest investigators, and has published their findings in a series of *Contributions to Knowledge*, and another of *Miscellaneous Collections*, both of recognized value. The *Smithsonian Annual Report* contains a yearly review of progress in science in popular language. It also conducts the International Exchange of scientific and governmental publications, to the great enrichment of the Library of Congress. Other bureaus under the direction of the Institution are the National Gallery of Art, the Freer Gallery of Art, and the International Catalogue of Scientific Literature. Recently a new division has been created, the Division of Radiation and Organisms for the study of the effect of radiation of various kinds on plants and animals. It would be difficult to over-estimate the intellectual service to the country performed by this institution and its branches. See also U.S. NATIONAL MUSEUM. E. I.

SMITHSONITE, an ORE of zinc, often called dry-bone by miners because of its porous character. In color it is white, greenish, yellow or bluish, varying from translucent to opaque. Smithsonite is the carbonate of zinc, and is the most important of the oxidized zinc minerals. Clear specimens are sometimes cut cabochon for gems. It crystallizes in the HEXAGONAL SYSTEM.

Smithsonite is found both in veins and beds, especially with galena and sphalerite. It usually occurs in the zone of oxidation, in calcareous rocks, often with CALAMINE, frequently replacing the rock. Commonly it is secondary, forming incrustations, stalactites, botryoidal and granular masses.

Colorado, Tennessee, Wisconsin, Mexico, Australia and Poland produce zinc from smithsonite. See also SECONDARY ENRICHMENT; WEATHERING; ORE DEPOSITS; GEM STONES; STALACTITES.

SMOKE, in warfare, a device used to conceal operations from enemy observation. Smoke may be used as a screen or curtain between opposing forces behind which operations may be carried on. However, screens of smoke do not offer obscurity to all observers and due to shifting winds and accidental apertures, are not as effective as when the smoke is placed upon

enemy observers. Smoke curtains and screens have a field of usefulness for retreating forces, but, where interference with directed fire is the aim, smoke is directed at enemy lines.

White phosphorus, chemically—yellow phosphorus, is the most effective agent that has been used for military obscurity. Other agents of value are stannic chloride and petroleum smoke.

In naval warfare smoke is produced from destroyer smoke-pipes or by spraying a liquid from airplanes. Torpedo attacks are made under cover of it and by its use a fleet can cover its maneuvers or engage an enemy while invisible to him.

SMOKE AND SMOKE PREVENTION. Since the introduction of mineral FUELS, smoke has become a matter of importance in all centers of population. This is particularly true where the common fuel is bituminous COAL. About 120 communities of the U.S. have promulgated smoke ordinances that have been enforced to a greater or less extent. The work is usually carried on by a number of smoke investigators who report those chimneys emitting quantities of black smoke, and then attempts are made to secure a better control of the conditions under which the fuel is being burned.

In general, anything which helps to bring about the burning of fuel under the best furnace conditions, particularly the proper supply of air, is an aid to smokeless combustion, and there have been many devices employed in the design of furnaces to secure this end. The most troublesome offenders are usually those attempting to burn too much coal in too small a space with too little air. The introduction of stokers has, without doubt, been the greatest aid in abating the smoke nuisance, particularly in the United States. In England, however, the worst offenders are the multitude of open-grate fires where bituminous coal is burned directly and without attention.

The present tendency in coal firing is towards the use of mechanical stokers on all kinds of furnaces, both household and commercial. This, coupled with the use of the many varieties of the less volatile coals, should give reasonably smokeless combustion.

The great increase in the use of oil burners and automobiles, all of which produce more or less smoke, is also of great importance in any smoke-prevention campaign. This subject has been only partially investigated but is worthy of much closer attention. See also GASES AND ATMOSPHERES, INJURIOUS.

G. A. O.

SMOKELESS POWDER. Smokeless powders may be conveniently divided into two major classes known as "bulk" and "dense."

Bulk powders depend entirely for their explosive nature on nitrocellulose. The grains or pellets of nitrocellulose are formed in a wheel mill and subsequently hardened by suitable solvent action. The ballistics of these powders compare bulk for bulk with black powder.

Dense powders are further divided into two classes known as single-base and double-base. Single-base

powders are composed entirely of nitrocellulose, while double-base powders are a combination of nitrocellulose with another explosive, particularly NITROGLYCERINE. Both types are made by colloiding or kneading to a dough the explosives with suitable solvents and usually a stabilizer as diphenylamine. After extruding through dies to obtain grains of proper size, the solvent is evaporated and the hardened grains dried.

Both bulk and dense powders are used for commercial (sporting) purposes. Military powders are practically limited to the dense type. The United States and France use single-base powders, while practically all other governments use the double-base type for military purposes.

Production of smokeless powders in the United States for 1930 amounted to approximately five million pounds of military types, and three million for commercial or sporting purposes. See also EXPLOSIVES; NITROCELLULOSE.

W. M. B.

SMOKE TREE (*Cotinus coggygria*), a large spreading shrub of the cashew family, native to Europe and Asia and widely cultivated for its attractive foliage and feathery flower clusters resembling small clouds of smoke. The name is sometimes applied also to the chittam-wood (*C. americanus*), a small tree native to the Southern States. The smoke tree



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

DESERT SMOKE TREE

Flowering branchlet and single flower

(*Dalea spinosa*) of the Gila and Colorado deserts is an intricately branched, spiny shrub or small tree of the pea family. It sometimes grows 20 ft. high with grayish bark, small leaves which fall soon after unfolding, brilliant blue flowers and short one-seeded pods. After the leaves and flowers have fallen the shrub at a distance often presents the appearance of wood smoke rising from a small fire.

SMOKY MOUNTAINS, a range belonging to the Appalachian system in eastern United States, and extending for 50 mi. along the boundary line between North Carolina and Tennessee. They rise from a

plateau formed by a widening of the Blue Ridge and are considered a subordinate division of the latter range. Next to the Black Mountains in North Carolina, the Smokies possess the highest peaks in the United States east of the Rockies, including Clingmans Dome, 6,644 ft., Guyot, 6,615 ft., LeConte, 6,580 ft., Collins, Jones Knob and Waterrock Knob, each about 6,400 ft. and Laurel Top, 5,900 ft. There are many others rising above 5,000 ft.

These mountains represent the last stand of primeval wilderness in eastern United States. The higher areas are covered with a jungle-like growth of rhododendrons, laurel and wild underbrush often impenetrable. The Sawtooth area which lies between Mt. Collins and Laurel Top on the state line is the roughest and wildest part of the mountains, forming a knife-like divide which few white men have ventured to cross. On the North Carolina side of the range there is a settlement of Cherokee Indians. In 1930 the United States government acquired 428,000 acres of the highest section of the Smokies for a national park to preserve the primeval state of the region and to protect the surviving ancient Appalachian flora found there.

SMOLENSK, administrative center of the Western Region of the R.S.F.S.R., on the Dnieper River in the east central part of the region. The Krivitchi, a Slavic people, made Smolensk their homesite early in the history of Russia. Located on an ancient highway of trade to Greece, its commerce with Constantinople flourished throughout the Byzantine era. Captured by Lithuania in 1404, Smolensk was incorporated into Muscovy a century later. Interesting sights of the town are the remains of its Kremlin, a five-domed cathedral and a regional museum with a picture gallery. Copper and iron are smelted in Smolensk, which also makes pottery, wooden articles and textile machinery. Pop. 1930, 89,239.

SMOLENSKIN, PEREZ (1842-85), Hebrew writer and editor born in Russia, February 25, 1842. Orphaned at the age of ten, he was thrown on his own resources for his support and education. Migrating to and from various communities in Russia, in 1862 he settled in Odessa where he studied modern languages and music, supporting himself by teaching Hebrew. His ambition to become an editor of a Hebrew magazine could not be realized in Russia. Smolenskin therefore migrated to Vienna where he found employment as a proof reader in a printing shop and established the *Hashachar*, a Hebrew magazine which in its day wielded much influence upon Jewish life in Eastern European lands. He edited also the Hebrew weekly *Hamabit*. In addition to a large number of essays which have been collected and published in six volumes (Jerusalem 1925) Smolenskin is also the author of several Hebrew novels which have gone through many editions. In his *Am Olam* or *Eternal People*, he expounded a theory of Jewish nationalism free from religious elements. He died at Meran, Austria, February 1, 1885.

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SMOLLETT, TOBIAS GEORGE (1721-71), British novelist, was born at Dalquhurn, Scotland, in 1721. At 18 he went to London with a play, *The Regicide*, but failing to sell it, enlisted as surgeon's mate on H.M.S. *Cumberland*, and saw active service at Cartagena in 1741. Five years later he settled in London to write and practice surgery. He published *RODERICK RANDOM* anonymously in 1748; in this he drew on his experiences, his journey to London and the brutal rawness of sea life in his time. Abandoning medicine altogether, he had great success with *The Adventures of Peregrine Pickle*, 1757, and wrote *Ferdinand Count Fathom* in 1753, the forerunner of many novels of horror. For the next few years Smollett was engaged in remunerative hack work, publishing various histories and editing several journals and periodicals. He went abroad in 1763 and published two volumes of *Travels* in 1766, and *The Adventures of an Atom*, 1769. While suffering from a painful illness he wrote *The Expedition of Humphrey Clinker* (see HUMPHREY CLINKER), generally considered his masterpiece. Smollett was an extraordinarily vigorous writer. Though his wit was often coarse, he is ranked among the great British humorists. He died at Leghorn, Italy, Oct. 21, 1771. See also ENGLISH LITERATURE.

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SMOOT, REED (1862-), American public official, was born at Salt Lake City, Utah, Jan. 10, 1862. He was educated at the Brigham Young Academy, at Provo, Utah, where he entered banking. He became interested in woolen manufacture, and was made director in financial and industrial firms in Salt Lake City. He was elected to the United States Senate in 1902, where attempts were made to unseat him because of his association with the Mormon Church, in which he was an apostle. These efforts failed, and Smoot was reelected in 1908, 1914, 1920 and 1926 on the Republican ticket. He was appointed chairman of the Finance Committee of the Senate, and was a member of the World War Foreign Debt Commission. In 1932 he was defeated for reelection to the United States Senate.

SMUT. The smuts are a group of basidiomycetous fungi belonging in the order *Ustilaginales*. They are all parasitic on herbaceous flowering plants. They have been called smuts because of the sooty black spore masses characteristic of many species. The spore masses are born in sori that develop in special parts of the host; they frequently occur in the ovaries where the mycelium from which they are produced takes the place of host tissues. The spore masses are usually conspicuous at maturity.

All of the smuts are parasitic but many of them can pass through a part of their life cycles as saprophytes. Some smuts infect their hosts during the seedling period only, some infect during the flowering stage only, while others can infect host plants during various periods in their development. Although the smuts at-

tack plants belonging in many different families they are best known as parasites of economic species in the grass family. They cause important diseases of sugar cane, corn, wheat, oats, barley, rye, rice and many other grasses. The annual loss from the smut diseases of cereals is very heavy in all of the principal agricultural countries of the world, a loss resulting both from a lowered yield and from the inferior quality of smutted grain. Various seed treatments and the substitution of resistant for susceptible varieties are some of the methods used in smut control. L. O. K.

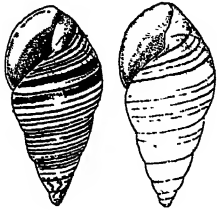
SMUTS, JAN CHRISTIAAN (1870-), South African general, statesman, lawyer, and scientist, was born at Riebeeck, West, Malmesbury district, Cape Colony, May 24, 1870. After studying at the University of Stellenbosch near Cape Town, he went to Cambridge, where he was graduated with honors in 1894. The next year he was admitted to the bar in Cape Town. He became state attorney in 1898. At the outset of his career he supported Cecil Rhodes, but after the Jameson Raid he sided with the Transvaal. During the Boer War he became commander-in-chief of the Transvaal and Cape forces. At the close of the war he favored a compromise peace. In 1904 he was a factor in the formation of the *Het Volk*, a society consisting of both Dutch and English members. He was tireless in his efforts to secure responsible government and South African union, and he had the satisfaction of seeing both these objectives realized in 1906 and 1910 respectively. In 1917 he was called to London as a member of the Imperial War Conference. He was a prominent delegate at the Paris Peace Conference and interested himself greatly in the League of Nations, his draft, *The League of Nations; a Practical Proposal* being used with several other plans by the Commission in drafting the Covenant of the League. Since the peace he has continued an ardent champion of the League and of international conciliation. His constructive statesmanship contributed much toward the development of the British Commonwealth of Nations, and to the evacuation of the Ruhr through the appointment and work of the Dawes Commission. In South African politics he has been a leader both of the majority and the minority forces. A student of philosophy and science since his Cambridge days, he is the author of *Holism and Evolution*, published in 1926. In 1925 he was president of the South African Association for the Advancement of Science.

SMYRNA. See *IZMIR*.

SNAIL, the common name for shell-bearing gastropod mollusks. Those living in salt water are usually called sea snails, and those inhabiting fresh water may be termed pond or river snails. Terrestrial species are sometimes distinguished as land snails. The latter require a considerable amount of moisture, but some snails can live even on deserts if there is a heavy dew fall. Most shelled gastropods belong to two orders, *Pulmonata* and *Prosobranchiata*, and there are many thousands of species, distributed all over the world.

The snail's shell serves as a house and a fort. It is

made all in one piece, univalve, and is secreted by the mantle. Characteristically it is spirally twisted, either toward the right or toward the left. Shells vary greatly in size, shape and color; the largest are some 2 ft. long, and the smallest are less than 1/16



TREE SNAIL SHELLS

in. long. The spiral shells are often somewhat round, like those of many common land snails, but sometimes they are long and slender, as with the spiral staircase (*Scalariidae*). Some, particularly the in-rolled cowry shells, when they are fully formed, show practically no trace of the original spiral of the larva.

Among the limpets the shell is conical and not at all twisted. The colors range from white to black, including the entire spectrum. They are often very handsomely marked, the cone shells, cowries and volutes being especially beautiful.

Snails have distinct heads, which bear one or two pairs of tentacles. The eyes may be placed either at the ends of the tentacles, or at their base. Their bodies undergo a peculiar torsion, so that in the adults the anus sometimes is twisted into such a position that it lies near the head. Often this results in the loss of the gill, kidney and auricle of the original left side.

Many snails are inactive vegetable feeders, but a few are carnivorous, and very energetic. Among the land and fresh water snails the majority are hermaphrodites; among the sea snails the sexes are more frequently separate. Most of them lay eggs, but in certain species the young are born alive. Both land and sea snails are eaten by man in many parts of the world, and the shells of many species are valued either for their external beauty or for the mother-of-pearl found within them, which is used commercially. Cowry and conch shells have been used for money by primitive peoples. Some vegetable feeders are harmful in gardens, and certain carnivorous conchs are destructive on oyster beds. *See also* ABALONE; CONCH; CONE SHELL; COWRY; HARP SHELL; HELMET SHELL; PERIWINKLE; LIMPET. A. I. W.

SNAKE, a generic name applied to various groups of North American Indians belonging to the Shoshonean linguistic stock, but more specifically to those tribes occupying eastern Oregon, who spoke the same dialect as the Paviotso of western Nevada and the Mono of southeastern California.

SNAKEBIRD, a name frequently applied to a genus (*Anhinga*) of large, web-footed aquatic birds native to warm regions, with very long snake-like necks. *See* ANHINGA.

SNAKE BITE. The only dangerous snakes in the United States are rattlesnakes, copperheads and cottonmouth moccasins. The small coral snake of the Gulf states is poisonous, but its bite is rarely fatal to an adult.

The danger of the bite of any snake is in propor-

tion to its size and to the amount of venom that enters the circulation. In cases where victims have died in an hour or less, the venom was probably injected directly into a vein. Snake bites are usually on one of the extremities and there is therefore a good opportunity to treat the wound. This should be done by preventing the spread of the venom through the circulation and by removing as much as possible of the poison from the wound. A tourniquet should be tied tightly around the extremity between the bite and the heart. The bite should be cut open without hesitation to promote bleeding; an x-shaped cut half an inch long and equally deep is sufficient. Suction should be employed to draw out the poison and this may be safely accomplished if the person who does it has no abrasions in the mouth. The tourniquet must be loosened for three or four minutes every half hour to prevent the extremity from mortifying from lack of blood.

If available, an injection of ANTIVENIN should be given at once and in any case as soon as it can be secured. Whiskey should not be given but the heart may be supported by strychnine. *See also* PURPURA.

SNAKE DANCE, a religious ceremonial performed by the Indians of the Hopi tribe in the north-eastern regions of Arizona. The presence of rattlesnakes is a remarkable feature of the dance, which is held in four of the seven Hopi pueblos. That held at Walpi in odd numbered years is now the outstanding example. After nine days of ceremonials held secretly in the kivas of the Snake and Antelope clans, the snakes, which are of several varieties but chiefly rattlers, are brought into the open plaza of the pueblo. They are sprinkled with sacred meal and the members of the Snake clan hold them in their teeth or in their hands during an elaborate ritual and dance. At the end of the dance the snakes are set free toward the four points of the compass. The dance is performed as a thanksgiving for the harvest and as a prayer for rain.

SNAKE-FLY, a neuropterous insect of the family *Raphidiidae*, native to Europe and the Pacific Coast. The thorax of the adult is greatly elongated, making it appear to have a long "neck." A long slender ovipositor is present at the tip of the abdomen of the female. The eggs are laid in deep crevices under bark of trees. Larvæ, found under the bark of trees, especially in orchards, are carnivorous. In California they are common on eucalyptus trees, feeding upon other insects, including the larvæ and pupæ of the codling moth. In appearance they somewhat resemble small dobson-flies. The pupa is not enclosed in a cocoon.

SNAKE RIVER, the chief river of Idaho and largest tributary of the Columbia. It heads in Shoshone Lake in Yellowstone Park, and flows south through Jackson Lake below which it passes through a steep canyon in the Jackson Hole country before entering the Snake River plains of Idaho. In this upper course it also drains the Teton Basin. In Idaho the river cuts a crescent-shaped course across

the southern part of the state to the western border line where it turns and flows north for 200 mi., forming the boundary between Oregon, Washington and Idaho. At Lewiston its course changes to westward through Washington and joins the Columbia River just below Pasco. Its length is 939 mi. and it drains an area of 103,835 sq. mi.

The course of the Snake through Idaho descends over broad benches produced by successive flows of lava. It is a succession of moderately level reaches interrupted by precipitous falls including the American, Twin, Shoshone, Auger and Salmon. Shoshone Falls is 210 ft. high, 43 ft. higher than Niagara. On its course north along the state line the river races down a deep gorge called the Grand Canyon of the Snake. After issuing from this canyon the slope to the mouth is gentle and the stream is navigable to Lewiston. Its chief tributaries are the Salmon, Boise and Clearwater from the right, and the Malheur and Owyhee from the left.

The Snake affords unlimited water power of which only a small amount has been developed. Its major use is supplying water to irrigate its basin which produces large crops of wheat, alfalfa and fruit. The American Falls Dam, completed in 1927, has a reservoir capacity of 1,700,000 acre-feet and serves approximately 600,000 acres. The Vale irrigation project on the Malheur River supplies water to 39,000 acres; the Arrowrock Dam on the Boise River serves over 200,000; and the Owyhee project near Adrian and Homedale reclaims 123,000 acres.

SNAKEROOT, the name given to numerous plants, the roots of which have been reputed remedies for snake bites or have a snakelike appearance. While their antidotal efficacy is slight several possess medicinal properties of value. Among these are the **SENECA SNAKEROOT** (*Polygala Senega*), the Virginia snakeroot (*Aristolochia Serpentaria*), the Texas snake-root (*A. reticulata*) and the black snakeroot (*Cimicifuga racemosa*). See also **ARISTOLOCHIA**.

SNAKES, members of a sub-order (*Ophidia*) of elongate, legless reptiles which belong to the same order (*Squamata*) as lizards.

There are over 2,000 species of snakes. They are found throughout the world in tropical and temperate latitudes, except on certain islands. The largest number of species live in the tropics, but snakes range further north than any other reptiles, and the individuals of certain species are exceedingly abundant in temperate lands. They can live in places where the winter is very cold because, during the winter months, they hibernate so deep below ground that the frost never reaches them. Most species live on the ground, but some are arboreal, some are semi-aquatic, and some are true sea-serpents.

Snakes vary in size from tiny creatures 6 in. long, smaller in diameter than an ordinary lead pencil, to giant pythons, 30 ft. in length, which may weigh over 300 lbs. They have scaled bodies, and forked tongues, which are exquisitely sensitive tactile organs. Their jaws are characteristically loosely articulated,

and extremely mobile. The teeth are sharp and curved; they are used not for chewing, but for holding the prey. Only about one-eighth of all species of snakes are provided with poison fangs, and but three-fifths of the venomous kinds are really dangerous to man. The primary purpose of the poison is to paralyze the snake's prey, so that it may be easily swallowed. Only on severe provocation is the poison used on such large, unedible creatures as man. Of the non-venomous snakes many species are constrictors, which suffocate their prey by wrapping themselves around the victims' bodies. Even the largest constrictors do not break the bones of the prey; they kill it by depriving it of air.

Almost all snakes are carnivorous. Their food ranges from such little things as ants' eggs and insects to wild swine, small deer and tapirs. Many species feed largely on rodents and occasional birds' eggs. These are valuable friends of the farmer. Others eat fish, frogs, toads, and lizards. A few feed exclusively on other snakes. Owing to their movable jaws and elastic skins their prey is sometimes relatively enormous; it may be considerably greater in diameter than the snake itself. Species which consume comparatively large animals may have a meal only every 10 or 12 days.

The majority of species lay eggs, which are hatched by the heat of the sun. A large number, however, bring forth their young alive. They shed their skins two or three times a year, and some of the larger species continue to grow all their lives. See also **REPTILES**.

A. I. W.

SNAPDRAGON (*Antirrhinum*), a genus of annual or perennial herbs of the figwort family comprising several favorite garden and greenhouse flowers. There are about 40 species native to the Northern Hemisphere, 18 of which are found in western North America. They are erect or climbing herbs, or sometimes subshrubs, with mostly opposite entire leaves and showy, somewhat tubular flowers inflated below and nearly closed at the throat by a palate-like structure. The common or large snap dragon (*A. majus*), a hardy biennial native to Mediterranean countries and naturalized in the eastern states, is very widely grown for its conspicuous flowers.

SNAPPER, a numerous family (*Lutianidae*) of perchlike, spiny-rayed, marine fishes, found in all warm seas. They are usually of large size, often over 2 ft. in length, with large mouths armed with sharp teeth. Deep water species are often bright red or rose-colored, while shore species are frequently greenish. Snappers are active, carnivorous, and voracious fishes, esteemed for food and somewhat as game fishes. The red snapper (*Lutianus blackfordi*), a well known food fish, 1 to 3 ft. long, is abundant on the Gulf coast. In 1929 the catch in United States waters was 9,987,000 lbs., valued at \$822,000. The gray or mangrove snapper (*L. griseus*), about 1½ ft. long, also used for food, ranges from New Jersey to Brazil. In 1929 the United States catch was 267,000 lbs., valued at \$14,000.

SNAPPER or **SNAPPING TURTLE** (*Chelydra serpentina*), an aquatic turtle readily recognized by its long tail, large head, ridged back, and small, cross-shaped plastron. Distributed from southern Canada through the United States east of the Rocky Mountains and Mexico southward to Ecuador, the snapper is well known to rural inhabitants for its ferocity and to fishermen for its greediness in taking bait. It attains a weight of 50 lbs. The snapper prefers, but is not confined to waters with muddy bottoms. Ponds, swamps and sluggish rivers are its choice haunts. A great variety of food is consumed including fish, amphibians, small mammals and even water-fowl. This turtle often wanders far from water to bury its eggs which are perfectly round and white. The alligator snapper (*Macrochelys temminckii*) of the southern United States sometimes exceeds 3 ft. in length and attains a weight of 150 lbs. C. H. P.

SNARE DRUM, a percussion instrument, the smallest drum used in an ORCHESTRA. See DRUM.

SNEEZEWEED, the common name for a genus (*Helenium*) of coarse herbs of the composite family, some of which are grown as garden ornamentals. There are about 30 species, natives of North America, some 20 of which occur in the United States. They are erect annual or perennial plants with alternate leaves and showy flower-heads with bright yellow or brownish, usually drooping rays. The best known

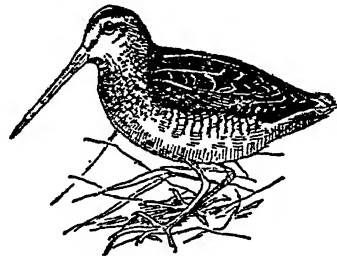


COMMON SNEEZEWEED

is the common sneezeweed (*H. autumnale*), native from Quebec to Manitoba and south to Florida and Arizona. It is a smooth leafy-stemmed perennial, 2 to 6 ft. high, with oblong decurrent leaves and handsome flower-heads, 1½ in. across. Numerous varieties with crimson or maroon flowers are in cultivation. The odor of the flowers is said to produce sneezing.

SNELLING, CHARLES MERCER (1862-), American educator, was born at Richmond, Va., Nov. 3, 1862. After graduating from Virginia Military Institute in 1884, he studied at Göttingen and Berlin. In 1888 he went to the University of Georgia, serving as adjunct professor of mathematics and commandant of cadets until 1906. He was professor and dean of Franklin College, University of Georgia, 1906-09; president of Franklin College, and dean of the university, 1909-25, and acting chancellor of the university from 1925-26, when he became chancellor.

SNIPE, a genus (*Capella*) of gamebirds allied to the woodcocks and sandpipers, frequenting grassy marshes and the edges of streams and ponds. There are about 23 forms, some 9 of which are found in the New World, though only one occurs in North America; the others are native to the Old World. They have rather slender bodies, pointed wings, short tails, and long straight bills, soft and sensitive at the tip, with which they probe in the mud for their food, which consists chiefly of worms, insects and their larvae. Their plumage, usually variegated with

G. M. SUTTON. "BIRDS OF PENNSYLVANIA"
J. HORACE MCFA

WILSON'S SNIPE

blackish, brown and chestnut above and lighter below, is marked with streaks on the head and back and bars on the sides and tail. Snipes nest on the ground in a slight hollow which they line with grass, and commonly lay four eggs.

Wilson's snipe (*C. delicata*), a handsome bird nearly a foot long, including the bill, inhabits freshwater swamps and meadows throughout North America, southward to Colombia and Brazil, nesting in the Canadian zone. It is very greatly esteemed as a gamebird, both on account of its excellent flesh and the skill required to secure it, its flight being both exceedingly swift and erratic.

SNOHOMISH, a North American Indian tribe, speaking the Nisqualli dialect of the North American Indian Salishan stock, formerly living on the southern end of Whidbey Island, Puget Sound, Wash., and on the mainland opposite the mouth of the Snohomish River. The survivors now live on the Tulalip Reservation.

SNOQUALMIE FALLS, a picturesque cascade on the Snoqualmie River in Washington, 28 mi. east of Seattle. These falls occur about 35 mi. from the mouth of the river and make a vertical drop of 268 ft. over a ledge 50 ft. wide. With their setting of

craggy bluffs overgrown with dark evergreens, they make one of the most beautiful spots in the Puget Sound country. Beneath the falls are dynamos generating power to turn the wheels of workshops and factories in Seattle and Tacoma and to run the street car system of Seattle.

SNOQUALMU, a North American Indian tribe of the Salishan linguistic stock which inhabited formerly the upper Snoqualmu River in Washington. The dialect spoken is the same as that of the Nisqualli with which group it is now identified.

SNOW, FRANCIS HUNTINGTON (1840-1908), American naturalist, was born in Fitchburg, Mass., June 29, 1840. He graduated from Williams College in 1862 and from Andover Theological Seminary four years later. In 1866 the newly established University of Kansas appointed him professor of mathematics and natural history. A long and distinguished service led to the building in 1886 of the Snow Hall of Natural History and, four years after to the naturalist's appointment as chancellor of the university and professor of entomology. All his work in the fields of ornithology, entomology and meteorology centered in this connection; he is best known perhaps for his discovery of a fungus destructive to the chinch bug. Snow died Sept. 20, 1908.

SNOW, one of the chief forms of precipitation, consisting of small crystals of ice which, having been formed from the freezing of water vapor at very great altitudes, fall to earth grouped together into flakes of various sizes. Being water in the frozen form, snow is a phenomenon associated with cold weather. It falls chiefly during the winter in the temperate zone, during nearly the entire year in high latitudes and never at the equator at sea level, being converted into rain before it arrives.

In higher altitudes snow may fall at all times and remain on the ground for any length of time. The lower limit where this perennial snow may occur is called the snowline; in latitude 70° it lies at 1,000 feet, at 40 degrees at 10,000 feet, and on the equator at 17,000 feet, although, especially in the temperate zone, these figures are subject to large local variations. At exceedingly great altitudes, such as the top of Mt. Everest, the atmospheric pressure is too low, and the snow evaporates quickly. Owing to the flimsy structure of snow flakes, the actual amount of precipitation in a fall of snow is not large; 10 to 12 inches of snow when melted equal about 1 inch of rain.

The perpetual snow accumulated to a depth of many feet may, under the influence of its own pressure, be converted into ice and form glaciers. Thus, tearing down mountains by erosion and turning them into soil, snow acts beneficially. Furthermore spread out as a blanket, it prevents the ground from losing too much heat. On the other hand the drifting of snow may constitute an impediment to all kinds of traffic; it may break trees and telephone wires by its weight, and when melting in spring cause widespread damage through floods, or in mountain regions constitute a constant menace through avalanches.

Snow is of a crystalline structure, varying widely in size and shape. Owing to the many facets on the crystals it reflects light strongly in all directions and appears as the most immaculate white. Snowflakes may vary from 0.01 to nearly an inch in size, the larger and warmer flakes falling from the lower clouds when the temperature of the ground is not much below freezing, while the smaller flakes originate in the higher, intensely cold clouds. Snow crystals belong chiefly to two varieties, and are either columnar or tabular in form; their structure is always hexagonal or triangular. The colder snowfalls generally exhibit the simpler forms of crystals; the very delicately patterned crystals built up into an intricate combination of fragile beauty and containing some air in occlusions originate in the lower clouds. Even when viewed under small magnification snowflakes show a rare and wondrous composition of great delicacy and detail.

W. J. L.

SNOWBALL (*Viburnum Opulus* var. *roseum* or *sterile*), a cultivated form of the Old World cranberry bush known also as guelder-rose. It is a deciduous shrub, 4 to 12 ft. high, with maple-like leaves and large globose heads of white sterile flowers. Numerous forms of this popular ornamental shrub have been developed in cultivation. The Japanese snowball (*V. tomentosum* var. *plenum*), a similar flowering shrub with large finely toothed leaves, is also widely grown.

SNOWBERRY (*Symphoricarpos albus*), a small shrub of the honeysuckle family, known also as waxberry. It grows wild from Nova Scotia to Alaska



FROM JEPSON. MAN. FL. PLANTS CALIF.. COPYRIGHT

SNOWBERRY

Longitudinal section of flower, fruit cluster and flowering branchlet

southward to Pennsylvania and California and is extensively cultivated as an autumn and winter ornamental for its large, snow-white, berry-like drupes. It grows from 2 to 6 ft. high with thin oval leaves, pinkish-white flowers and fruits about $\frac{1}{2}$ in. in diameter.

SNOWBIRD, a small bird (*Junco hyemalis*) of the FINCH family (*Fringillidae*), called also the slate-colored junco, found widely in eastern and northern North America. It is about the size of an English sparrow, slaty gray throughout, except the two outer tail feathers and the belly, which are white. The snowbird breeds from Massachusetts to Minnesota and northward to the limit of trees in Canada and Alaska, building a compact nest on or near the ground and laying 4 or 5 finely speckled whitish blue eggs. It feeds chiefly on seeds and insects. In summer the snowbird has a sweet pleasing trill, but in winter it utters only a short chirp. Throughout the eastern United States it is a favorite winter visitor, appearing in flocks when the snow begins to fall. The snow bunting is sometimes called snowbird. Seven species of juncos and a number of subspecies are found in western United States.

SNOW BUNTING, a small bird (*Plectrophenax nivalis*) of the FINCH family (*Fringillidae*), called also snowflake and SNOWBIRD. It occurs widely throughout the Northern Hemisphere, breeding in the arctic zone up to lat. 83°. In North America the snow bunting winters chiefly in southern Canada and in the northern border of the United States appearing in large flocks with first snows. According to F. M. Chapman it "is the only one of our sparrow-like birds that has white predominating on its wings as well as on the body." It is about 7 in. long, with a cheerful temper and a pleasing song, living on the ground and feeding upon seeds. In a well-lined nest it lays four to seven bluish-white eggs, marked with reddish brown.

SNOWDEN, SIR PHILIP (1864-), English statesman, was born July 18, 1864, in Cowling, Yorkshire. For a time he was engaged in the Civil Service, but abandoned it at 30 to write and lecture in support of the Independent Labor Party, of which he

was one of the earliest members. He has been a Labor member of Parliament since 1906, except from 1918-22, and has three times been Chancellor of the Exchequer: in 1924, from June 1929 to Aug. 1931, and in the National Government formed then. On Nov. 26, 1931 he was made Viscount Snowden of Ickornshaw. He has been a member of several royal commissions—Canals and Waterways, Civil Service, Venereal Diseases, and during the war he served on



SNOWDROP

the Central Liquor Control Board. His books all deal with economic and social questions, some of their titles being *Socialism and the Drink Question*, *The Living Wage*, *Socialism and Syndicalism*, and *Labor and the New World*. An ardent Socialist, he has fought

valiantly for party programs and governmental measures that would tend toward equalizing wealth and opportunity, and ameliorating the living conditions of the workers.

SNOWDROP (*Galanthus nivalis*), a small bulbous plant of the amaryllis family widely cultivated as an early spring ornamental, often flowering before snow has disappeared. The plant is a native of Europe and western Asia, very hardy and easily grown in borders. It bears smooth, grasslike leaves and a slender flower-stalk, about 1 ft. high, with a single nodding white flower.

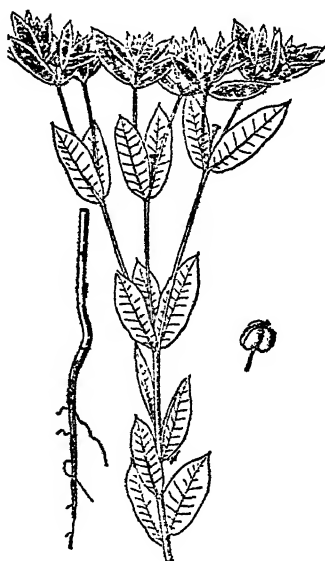
SNOWDROP-TREE, a name sometimes applied to the silver-bell, a handsome ornamental tree of the styrax family, native to the southern United States.

SNOWFLAKE, a name often applied to the SNOW BUNTING (*Plectrophenax nivalis*), a small sparrow-like bird with predominantly white plumage, breeding in the arctic and appearing in flocks in southern Canada and the northernmost states with the first snows.

SNOW-HOUSE. From the Mackenzie River in Canada eastward, the dome-shaped house built up from domino-shaped blocks of snow, with its low, tunnel-like entrance which may be from 10 to 30 feet long, is the principal winter dwelling of the Eskimo (see also IGLOO). Some Eskimo groups like those of the Mackenzie River area, use the snow-house only as a temporary winter dwelling, while to the eastward, especially among the Copper Eskimo of the Coronation Gulf district, it is used throughout the winter. As a dwelling in summer the snow-house is impractical, because the drip from the roof and walls makes the house uninhabitable. Except for the Eskimo around Point Barrow, where a carelessly constructed snow-house, rectangular in ground plan, has been observed, the Alaskan Eskimo generally do not use this type of house. Ordinarily the snow-house is only large enough to accommodate two or three people in which case it may be no more than 6 or 7 feet in diameter and 5 to 6 feet in height at its highest point. It varies, however, in size, according to need and may be made large enough to accommodate as many as 30 or 40 people for a dance or other special occasion. The snow-house is ordinarily built in a spiral upward and the domino-shaped blocks of snow are trimmed to fit together. About two thirds of the interior is occupied by a skin-covered bed platform built up of snow or preferably of wooden planks. Around and under this are stored various household and other implements. Snow-house building is the work of the men.

SNOW LINE, the variable line marking the edge of perpetual snow on lofty mountains. The height of the snow line, determined largely by temperature, is greatest in the torrid zone, dropping towards both poles. Thus, in the Himalayas, it averages 19,000 ft., in the Rocky Mountains 11,000, in the Alps 7,500 to 9,000, in Iceland 3,000 while in Spitzbergen it approaches sea-level. The snow line varies locally with the weight of snowfall and humidity. In Alaska

the snow line descends notably on the seaward side of the mountains where the heaviest snows fall. No peaks in the eastern United States rise above the snow line.



SNOW-ON-THE-MOUNTAIN
Whole plant, one-third natural size, and
seed capsule, natural size

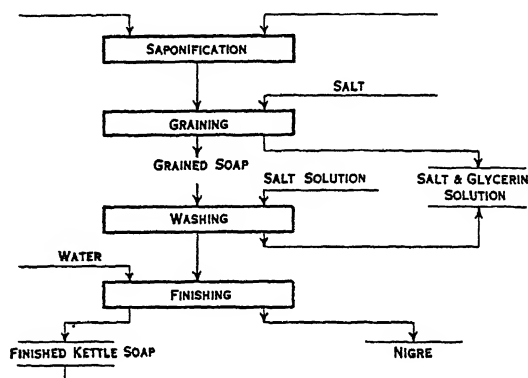
SNOW-ON-THE-MOUNTAIN (*Euphorbia marginata*), a handsome annual of the spurge family, native to the Great Plains region and widely cultivated as a garden ornamental. It grows about 2 ft. high with oblong, light green leaves, the uppermost of which, together with some of the floral appendages, have conspicuous, white, petal-like margins.

SNOW PLANT (*Sarcodes sanguinea*), a fleshy bright red or crimson parasitic herb of the heath family, found in pine woods at elevations of 4,000 to 8,000 ft. from Lower California to southern Oregon and western Nevada. Through the carpet of pine needles left by the melting snow the plant sends up in earliest spring its thick red stem, 6 to 15 in. high, covered below with scales instead of leaves and ending above in a long dense cluster of drooping flowers. Because of its somewhat flamelike appearance, strikingly in contrast with nearby unmelted snows, the plant is one of the most popular in the western mountains. State and federal regulations have been established to prevent its extermination.

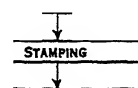
SNOWSHOEING, a means of walking on deep snow, originally developed for practical purposes, but

now a leading winter sport, especially among colleges and resorts of the northern United States and Canada. In winter carnivals, snowshoe races are among the most popular events.

The snowshoe may still be seen in its primitive form among Eskimos and North American Indian tribes, the design differing with the locality. The bear paw type, which has no tail, is oval or almost round. This is used where there is brush and timber. For open country, a long, narrow racing type shoe is best. The Canadian winter sports clubs have adopted a shoe about 3½ feet long and 15 to 18 inches wide. The front is slightly turned up to prevent the



CUTTING BARS



A FLOW SHEET OF SOAP MAKING

toe catching if there is a slight crust, and the tail is usually weighted to make turning easier.

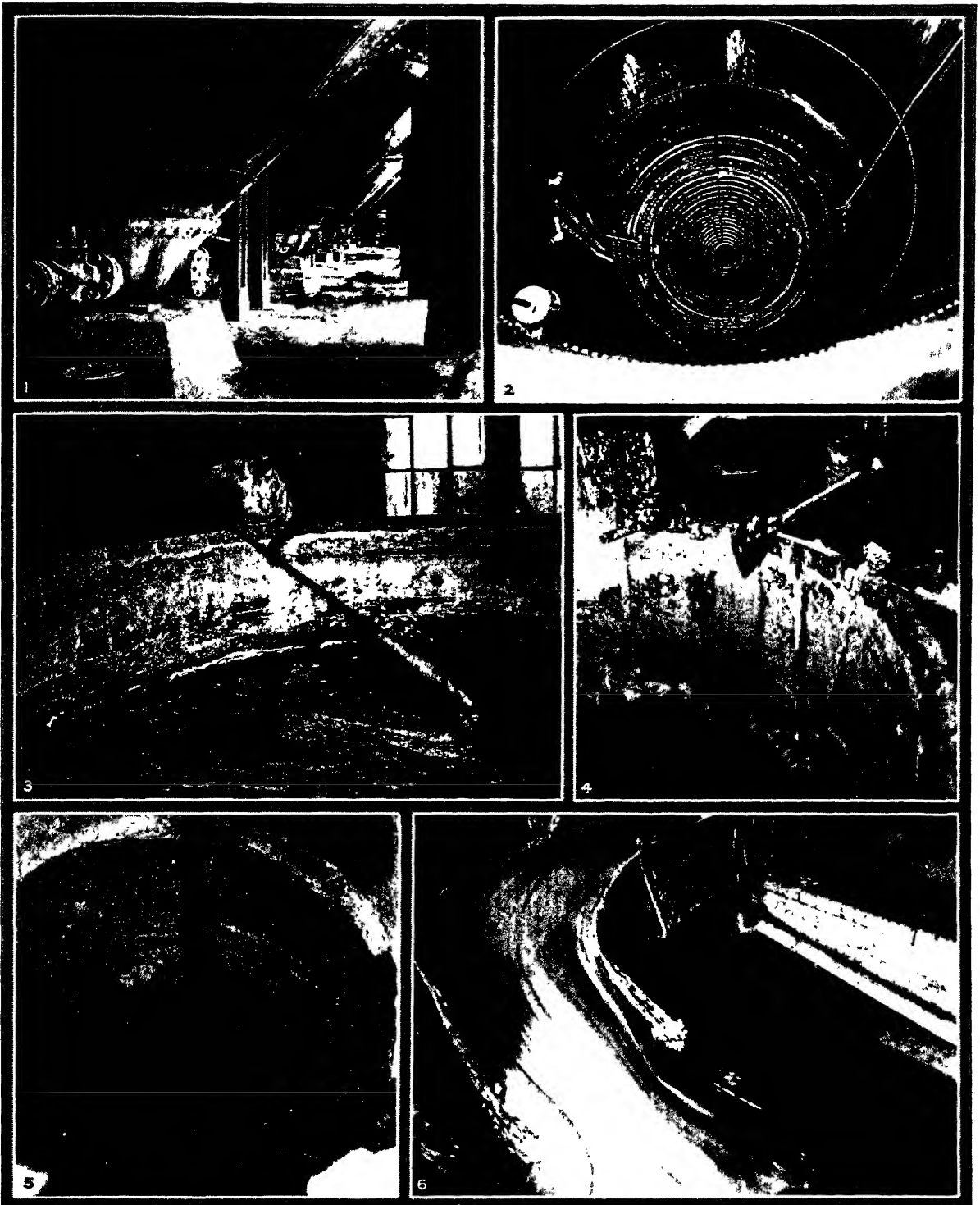
When snowshoeing, the lumberjack wears a rubber shoe with a leather top; but the Indian mocassin is much better as footwear. The snowshoe usually has a leather toe-piece attached between the two wooden crossbars.

SOANE, SIR JOHN (1753-1837), English architect, was born at White Church, near Reading, Sept. 10, 1753. He studied architecture in Italy for three years, then returned to England, and in 1788 drew the plans for the Bank of England. In 1806, he occupied the chair of architecture at the Royal Academy, of which he had been elected in 1802. He presented his valuable collection of antiquities, together

FROM JEPSON, MAN. FL.
PLANTS CALIF., COPYR

SNOW PLANT

SOAP



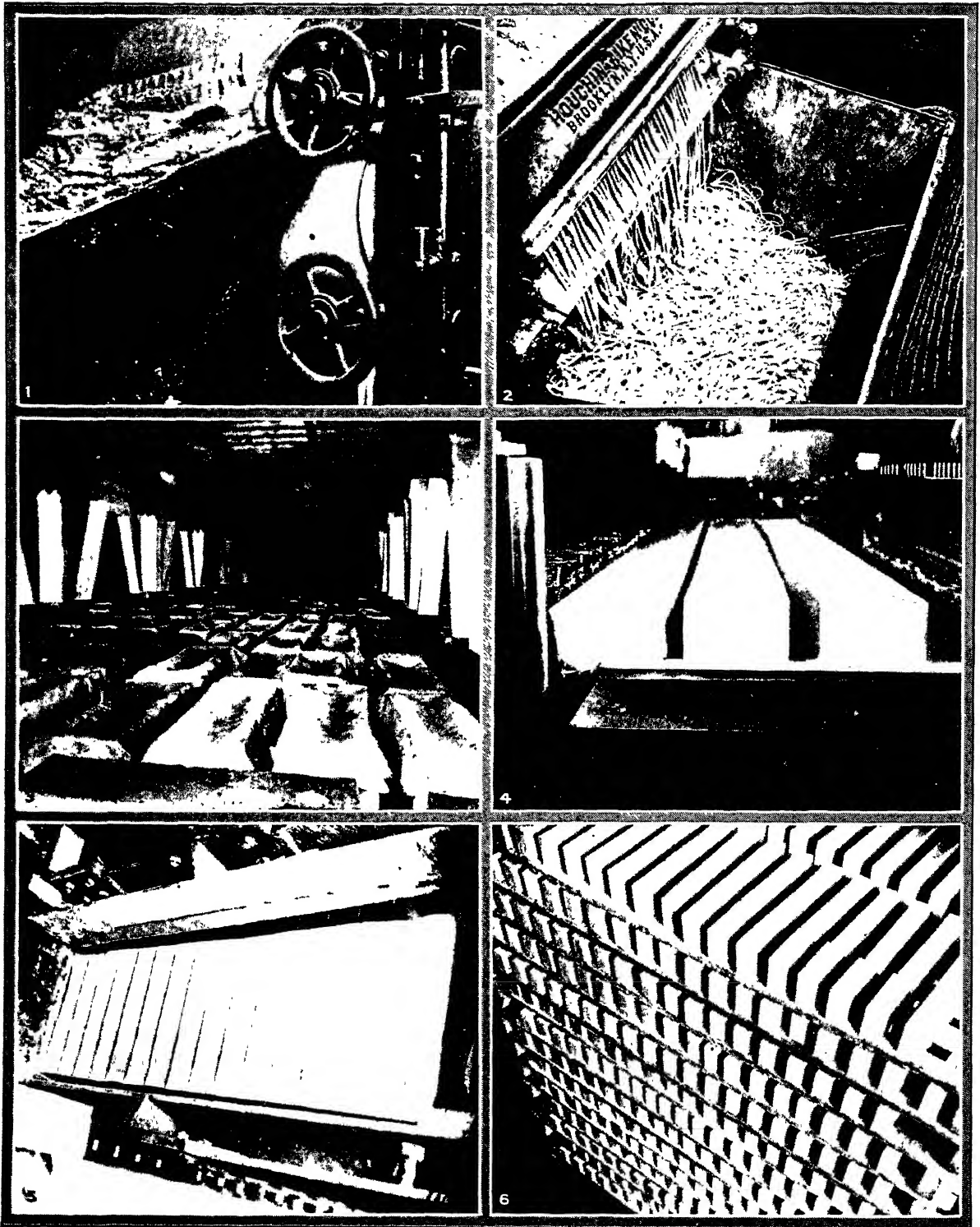
COURTESY PROCTER AND GAMBLE CO. CINCINNATI, O.

IN A LARGE SOAP MANUFACTURING PLANT

1. Underside view of a battery of huge kettles in which the melted fats and caustic soda are boiled. 2. Interior view of one of the large soap kettles, showing the perforated coils of steam pipes. 3. Soap maker stirring a

batch to test its consistency. 4. Salt being added to grain the soap. 5. The stock, comprising the melted fats and soda, being poured into the kettles. 6. Soap pouring from the crutcher into a frame where it cools and is cut into bars

SOAP

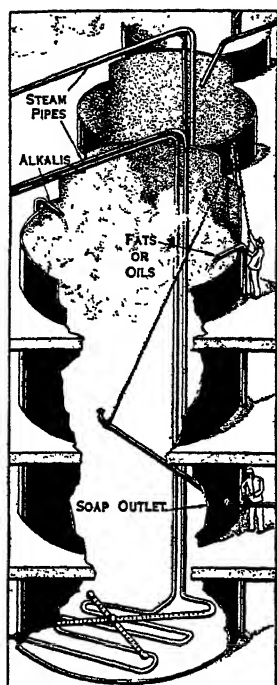


COURTESY PROCTER AND GAMBLE CO., CINCINNATI, O.

LARGE SCALE PRODUCTION OF SOAP

1. Knives scraping the soap from the rolls.
2. Soap falling from the knives into hoppers.
3. Aging the soap on frames.
4. Piano wires slicing the slabs.
5. Continuing the slicing process.
6. Bars ready for stamping with maker's name.

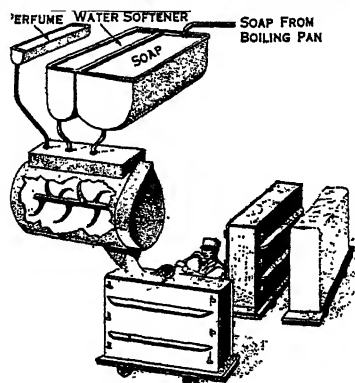
with an endowment, to the British nation in 1835. The collection is now known as the Soane Museum. Soane died in London, Jan. 20, 1837.



COLGATE-PALMOLIVE PEET CO.
SOAP BOILING

SOAP, the product formed by the action of lye upon fats and chemically consisting of the alkaline salts of fatty acids. The chief acids involved are stearic, palmitic and oleic acid; their sodium salts form the hard soap, the potassium compounds constitute the soft soaps. Since the fats occurring in nature are the glycerine esters of these fatty acids, the production of soap from them by the simple addition of lye liberates glycerine; accordingly several processes of soap-making are distinguished. In the one most extensively followed, the fat is heated by means of steam in large iron pans, and alkali, usually, caustic soda added slowly. After the mixture has become uniform, salt is added—an operation called "graining."

The soap, which is insoluble in brine, precipitates out, and, being lighter than water, floats on the surface while the liquid underneath, called the "spent lye" and containing the liberated glycerine, salt and excess lye, is



MANUFACTURE OF SOAP

The hot liquid soap is drawn from the soap pan into "crutchers" for further mixing with water-softening ingredients. It is then poured into frames or moulds with removable sides

drawn off. After washing out the brine, the soap is again boiled up and allowed to settle. The top layer then formed contains frothy soap, the second layer, some 80% of the material, the good soap, while underneath are found the "nigre," a darkly colored, inferior soap, and some watery lye. For the cheaper soaps this

second layer is used directly, while for the better grade soaps it is first "filled" by mixing it with substances such as sodium silicate which make it firmer.

Perfumed, and colored toilet soaps are made by shredding and drying the crude soap, mixing it with crystals, dyes and fluids and "milling" it, by repeatedly passing between rollers. In another process soap is made by simply boiling the fats with lye and superheated steam, or, in the "cold process" by merely mixing the oils and lyes at a temperature considerably below the boiling point.

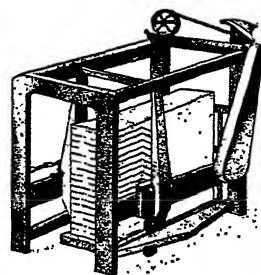
These processes are very simple but, since they leave the glycerine in the soap, are best applicable in the manufacture of soft soaps. Marine soaps soluble in salt water are made from coconut and palm-kernel oils. Tallow is generally used for the harder soaps and olein for the softer, while shaving soap must be made with a proper mixture of potassium and sodium lye in order to be of the correct consistency. Transparent soaps usually contain resin and considerable glycerin,

medical and disinfectant soaps such substances as phenol, or lysol. Soap is used principally for cleaning purposes because of its detergent properties since its watery solution, being a kind of emulsion, absorbs, and "loosens" the dirt and thus carries it away. Soaps, especially the softer types, also find a wide application in the textile industry. See also FACE PREPARATIONS; BATH PREPARATIONS. W.J.L.

SOAPBARK TREE (*Quillaja Saponaria*), a medium-sized evergreen tree of the rose family. It is native to Chile and Peru and cultivated in various countries for its bark known as quillai or soapbark. The tree grows 50 to 60 feet high, bearing rough bark, dark without and whitish-yellow within; smooth, shining, oval leaves; white flowers, and winged seeds. The powdered bark, rich in saponin, a glucoside that forms a soapy lather with water, is used for cleansing fine woollens and other fabrics. The bark is the source of commercial saponin, a white poisonous powder.

SOAPBERRY (*Sapindus Saponaria*), a small tree of the soapberry family, native from southern Florida and the West Indies to Venezuela and Ecuador, cultivated for ornament and for its pulpy fruit used as a substitute for soap. It grows 20 to 30 ft. high with light gray flaking outer bark and black inner bark, oblong evergreen leaves, small white flowers blossoming in Florida in November, and globular fleshy fruit with large bony black seeds ripening in spring.

SOAP INDUSTRY, UNITED STATES. This industry comprises establishments engaged primarily in the manufacture of soap and soap products, together with



CO., CHICAGO

CUTTING SOAP INTO BARS

The soap is allowed to cool and harden. Then, with taut wires, it is cut into slabs, the slabs into bars, and the bars into cakes. Stamping and wrapping complete the process

the soap departments of large slaughtering and meat packing plants. The principal products are (1) toilet soap, laundry soap, soap chips, and other hard soaps; (2) granulated soaps, powdered soaps and soap powders; (3) shaving soap, cream and powder; and (4) soft, liquid and paste soaps.

SOAP MANUFACTURE, U.S., 1909-1929

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1909	420	12,999	6,226,882	111,357,777
1919	348	20,436	21,228,063	316,740,115
1925	272	15,406	18,526,104	278,273,107
1929	282	14,363	18,994,656	310,191,530

Among the states separately reported by the Census as leading in production in 1929 were Ohio, New York, Illinois, California and Pennsylvania.

SOAP PLANTS, numerous plants belonging to various botanical families which contain the poisonous glucoside *saponin*. This has the power of forming a lather with water, hence the crushed bark, roots, stems, or other parts of plants containing this principle may be employed as a substitute for soap. Since ancient times the leaves and roots of the common **SOAPWORT** (*Saponaria officinalis*), and of the closely allied cow herb (*S. Vaccaria*) have been used for washing fabrics. The powdered bark of the **SOAPBARK** tree and the pulpy fruit of the **SOAPBERRY**, both natives of tropical America, are utilized for cleansing fabrics, especially fine woollens. In the southwestern United States the small agave (*A. heteracantha*), the soaproot (*Ornithogalum pomeridianum*), and the **ZYGADENE** (*Zygadenus Fremontii*) called amole by the Indians, were employed as soap plants.

SOAP SCULPTURE, the carving of small sculptures from white soap. Soap as a sculptural medium has lately attained considerable popularity. While the sculptures are necessarily small, the texture of soap, smooth and firm yet readily fashioned, makes it an interesting medium, particularly for practice work. Its destructibility precludes it from permanent work. Soap sculpture has been greatly stimulated in America by competitions. The first was held in 1924 and attracted over 1,000 entries, which were exhibited in New York and elsewhere throughout the country.

SOAPSTONE. See **TALC**.

SOAPWORT (*Saponaria officinalis*), a stout smooth perennial of the pink family, called also bouncing Bet, formerly utilized as a soap plant and now widely grown in numerous varieties as a garden ornamental. It is native to Europe and western Asia and very widely naturalized as a weed in North America. The plant grows 2 or 3 ft. high bearing numerous oblong three-nerved leaves and showy pink or white flowers in dense flat-topped clusters. See also **SOAP PLANTS**.

SOARING, a special form of **GLIDING** in which the **GLIDER**, taking advantage of the wind currents, is made to maintain or to increase its altitude. Soaring has been divided into two kinds, static and

dynamic. In *static* soaring altitude is maintained or attained by the means of rising air currents. In *dynamic* soaring the forces resulting from changing velocities and directions of horizontal wind currents are utilized. While dynamic soaring may be demonstrated mathematically, it exists, at least as far as human soaring is concerned, only on paper.

Rising currents are of two kinds, those produced by obstacles in the wind path, and those due to heated air. When the vertical velocity of the ascending air equals the sinking velocity of the glider, horizontal flight is maintained. When the ascending velocity of the air is greater, the glider will rise. In all soaring flights the glider is "coasting down hill" as in the case of the ordinary glide, the difference being only the existence of rising air which either equals or exceeds the rate at which the glider would normally lose altitude. The best soaring planes are those which have flat gliding angles combined with low sinking velocities. R. S. B.

SOBIESKI, JOHN III (1624-96), King of Poland, was born at Olesko, Galicia, June 2, 1624. He defended Poland against the Cossacks, Swedes, and Tartars. In 1672-73 he defeated the Turks and in 1674 the diet elected him king of Poland. On Sept. 12, 1683 with a small army he successfully defended Vienna against a Turkish army of over 250,000. Sobieski followed up his victory by forcing the Turks out of Hungary and restoring the country to the emperor, Leopold I. He died 1696.

SOCIAL CHANGES. That times have changed is an aphorism that indicates that modifications occur in the conditions under which man lives his social life, as well as in social life itself, although what it is that changes is not altogether clear from the expression. In general it may be stated that it is not man as a biological organism or the physical environment that undergo modification, for both of these are relatively constant. When the times change it is, rather, because acquired group habits of men have been changed or transformed. Formerly it was the habit to drive behind a horse; the automobile habit has now been substituted and the times have changed.

The collective habits of individuals, and their interrelationships, which are transmitted from generation to generation constitute the culture of a group. A society may be defined as a group with a distinguishing culture. Every culture may be regarded as composed of non-material and material elements, all of which man himself creates in the process of invention. Non-material culture includes the customs, manners, codes, techniques in general, ways of doing and thinking. Material culture consists of tangible objects.

Individuals are born into societies and adjust themselves to the prevailing culture. That is to say they acquire after birth the habits of the group. As inventions occur, spread and cumulate there follows a necessary modification or complete replacement of older habits; individuals live differently. Social change tends to occur slowly in small groups where the cul-

ture is meager and rapidly in groups where the culture is intricate and extensive, because the inventions that induce changes have their origin in the existing culture; the more extensive the culture, the greater the possibility of invention. Always, however, social change takes place because man himself, by invention, is reshaping the culture in which he lives.

M. M. W.

BIBLIOGRAPHY.—W. F. Ogburn, *Social Change*; W. D. Wallis, *Culture and Progress*.

SOCIAL CLASSES, divisions based on economic status, although the stratification may be reinforced by custom, tradition, religion and other sanctions. The economically powerful class dominates and maintains its position through the governmental machinery. The state on the other hand maintains itself through military power. The class in power also sustains itself by retaining the greater proportion of professionally trained individuals. Thus the clergy, lawyers, engineers and other educated elements are usually dependent upon the dominant class. Before the INDUSTRIAL REVOLUTION land ownership was the economic basis of class distinction and power. Since the growth of industry and commerce the ownership of money or capital in its various forms is the prime basis of power.

Before the industrial revolution society was rigidly divided into castes and a person born into a caste could neither rise nor sink from it. Since the industrial revolution the hereditary basis of class demarcation has become unimportant and the purely economic basis is serving more openly as the distinguishing characteristic. This change has brought about a greater fluidity of classes. There being no custom or legal control, an individual can rise or sink from class to class. However, the economic restraint has limited opportunities so that most individuals are actually restricted to the class into which they are born. It is only the exceptional individual or the one who is fortunate in securing access to the limited opportunities who can rise out of his class.

In Europe where the customs and traditions of pre-industrial revolution days persist, and where economic opportunities are more limited, society even under capitalism is rigidly adjusted so that there is less fluidity of classes. In the newer countries like the United States, which was not vitally influenced by medieval traditions and which is still expanding and growing, there has been greater fluidity. However, as concentration in ownership and control of wealth continues, a proportional diminution in the fluidity of classes is inevitable even in the newer countries.

At present there are four outstanding classes. The smallest in numbers but the most powerful, is the capitalist class, which owns and controls most of the wealth, and secures its income from this ownership. The middle class or *petite bourgeoisie* is large in numbers but relatively weak in economic power, since most of the individuals in this class own just enough wealth to enable them to continue in business in order to gain an income. The peasant or farmer is the

prototype of the *petite bourgeoisie* in that he owns the equipment and the land which he works for a living. The status of these two classes is very precarious since critical economic conditions affect them most vitally.

The proletariat or working class has grown tremendously under capitalism. Relying primarily on their wages for a livelihood the workers have the least security. While the condition of this group has steadily improved, wages have not increased proportionately to the increase in production and wealth.

The existence of social classes has led social philosophers to evolve theories explaining the origin of classes. The conservatives hold that classes are an outgrowth of nature; the liberals contend that they are based on special privileges; and the socialists maintain that they are traceable to the private ownership of property.

D. J. S.

SOCIAL CONTRACT, a doctrine elaborated by Hobbes, Locke and Rousseau in the 17th and 18th centuries involving the idea of an original compact instituted by voluntary agreement, a compact to which every state is assumed to owe its existence. The doctrine assumes in addition a primitive state of nature prior to the original compact. Hobbes in the *Leviathan* (1651) pictures the primitive state of nature as a stage in which every man was arrayed against every other man, and the law of self-preservation, Hobbes maintains, dictated the creation of a sovereign ruler to extend the blessings of peace to an otherwise brutish existence. Locke in the *Treatise of Civil Government* (1690) contended that the primitive state of nature was one of freedom and equality rather than a state of brutish warfare. But the obvious necessity of a judge in civil disputes, asserted Locke, led to the social compact and the creation of a judge and ruler. But whereas Hobbes drew the inference of the necessity of an absolute sovereignty, Locke derived the ideal state as a limited constitutional monarchy. Rousseau with whom the idea of a social contract is most often associated by popular consent, published his *Social Contract* in 1762. He tried ingeniously to harmonize the doctrines of Hobbes and Locke and held that although the sovereignty is absolute, it nevertheless rested ultimately on the consent of the governed and could be changed at the will of the latter. The doctrine of the social contract contributed largely to the intellectual ferment that preceded the French Revolution. See also THOMAS HOBBES; JOHN LOCKE; JEAN J. ROUSSEAU.

SOCIAL CONTROL, a term first used by sociologists to denote those influences of the environment which play upon the individual, such as customs, taboos, ceremonies and beliefs. As currently used by the economists, however, it refers more narrowly to the consciously planned guidance of social processes. In this narrower sense social control has become the focal point for many significant and controversial problems. The emergence of these problems is due largely to the breakdown of individualistic assumptions both in the sphere of economic enterprise and in fields such as ethics, education, psychology, religion and law.

The economic depression of 1930-31 gave concrete reality to the need for new forms of control, and the Russian experiment has made familiar at least one type of planned economy.

The actual controls at work in any society differ from age to age. In the present period there are a vast multiplicity of controls among which the government, the family, the school, the church and those agencies of communication such as the press, the radio and the movie may be counted as the most important. Business activity, nominally carried on under a system of free enterprise, is actually modified by a network of legal restraints, by institutions such as administrative commissions, by the pressure of trade unions, Chambers of Commerce, trade associations, codes of business ethics, as well as by a host of habits and conventions of business procedure. There is increasing recognition of the fact that isolated individual judgments do not necessarily add up to a coherent policy and that far more concerted action is needed to achieve a well-balanced economic system. The problems of social control come to clearest focus when one tries to answer the question of what instrumentalities should have control in charge. And this leads to the even more fundamental question of the aims toward which social control should move. H. E.

SOCIAL DEMOCRATIC PARTY, organized in 1897 under the leadership of Eugene V. Debs and Victor L. Berger. It differed from the **SOCIALIST LABOR PARTY** in concentrating upon the triumph of political socialism rather than upon the reorganization of industrial society, and in its tolerance of trade unionism. Debs was its presidential nominee in 1900, polling 87,814 votes. After 1900 the party adopted the name **SOCIALIST PARTY**.

SOCIAL EVOLUTION, a term meaning the development of societies and cultures over past periods of time. Since anthropological and archaeological evidences establish the great antiquity of man, human society and culture are known to have had their beginnings long before the invention of writing and architecture. Consequently knowledge of the earlier stages of social evolution is not based upon historical records but upon such evidence as tools, implements, pottery and modes of burial of the dead. Thus understanding of early social evolution is largely a matter of theory carefully constructed to fit the scant facts available. It follows from this that there have been many different theories of social evolution. At one time the consensus of opinion favored the idea of a succession of stages: hunting and fishing, pasturage, agriculture and finally industry; or, savagery, barbarism and civilization. It was thought that in each historical culture people passed through, these stages followed inevitably and in a predetermined sequence. Such over-simplified explanations have been generally discredited and opinion now inclines to the theory that each culture passes through its own cycle of development, equilibrium and decline, modified more or less by borrowings from other cultures, but never following a common and fixed sequence of identical

stages. Study of the skeletal remains of prehistoric man shows that little anatomical change has occurred in 10,000 years. Thus the biological basis of recent social evolution has remained a nearly constant factor.

F. S. C.

BIBLIOGRAPHY.—C. Wissler, *Man and Culture*, 1923; F. S. Chapin, *Cultural Change*, 1928; W. D. Wallis, *Culture and Progress*.

SOCIAL HYGIENE. Social hygiene in its broadest sense deals with all aspects of social health; and in European, Asiatic and South American countries the term is generally so used. In the United States, however, social hygiene agencies have concerned themselves primarily with the problems that center around the family as the basic social unit; and thus far most of these problems which have received public recognition have grown out of the sex instinct. The history of the social hygiene movement in the United States goes back at least fifty years. Proceeding at first along several independent lines—the voluntary agencies concerned came together in 1914 in one national organization, the American Social Hygiene Association, affiliated with voluntary state and community agencies throughout the country. The Federal government has promoted many activities in the field of social hygiene through the Division of Venereal Diseases of the Public Health Service, the Children's Bureau, the Office of Education, and other Federal agencies. Most state governments, and many city and community health, education and welfare departments include social hygiene activities in their programs.

These social hygiene programs cover a wide range of activities, such as the development of sex education in relation to character education, organizing the community for effective medical and public health treatment of the venereal diseases, combating the commercialized exploitation of men and women in prostitution, the promotion of environmental conditions and recreational facilities calculated to protect youth and foster normal family life. The educational aim is largely to prepare the youth of both sexes to understand the reproductive system and to make sound personal adjustments to the sex factor in life; to prepare them for successful marriage, parenthood and family responsibilities; and to equip them with the knowledge necessary for leadership in dealing with social hygiene questions arising in the communities in which they live. The medical aim is to make provision for advice, diagnosis, and treatment of various types of disturbance and non-infectious diseases of the sex organs; and for the recognition and treatment of syphilis and gonococcus infections as dangerous, communicable, preventable and controllable diseases whose victims must be given the same thorough sympathetic scientific attention which is given all other recognized infectious diseases. The legal and protective aims are concerned chiefly with eradicating the third-party interests in commercialized prostitution—those environmental, political, and business interests which combine to promote for gain the

exploitation of men and women in sex practices which are anti-social, degrading, and damaging particularly to youth and to the family; the building up of counteracting influences through wholesome recreation, leisure-time activities, and friendships of men and women.

In practice, these programs work out largely through the activities of agencies not known as social hygiene societies or official departments. Instruction, for example, is frequently given through selected courses in biology, physiology, sociology, psychology, home economics, physical education, religious education. Courses on citizenship and on the art of living are being advocated, to include from the social hygiene field essential biological facts; development of the sex instinct in the child, the adolescent, and the adult; heredity and eugenics in relation to the human family; marriage as an institution based upon normal expression of the sex instinct; the values and penalties of normal and abnormal sex expression, as indicated by desirable and undesirable physical, mental and social consequences. Similarly, medical, legal, and protective activities are distributed through the programs of many scientific and social welfare agencies.

In recent years, debatable problems of marriage and the family and of the so-called "psychology of sex" have been prominently before the public for discussion in advance of adequate knowledge or well considered plans for their solution. These are being slowly analyzed and carried through the recognized processes of science and sociology for arriving at practical proposals. Such serious questions in the general field of social hygiene, as BIRTH CONTROL, ALCOHOLISM, DRUG ADDICTIONS are being studied widely in the United States and in other countries. Marriage and related social, religious, and health factors are receiving special consideration. Family consultation services are proving valuable additions to existing provisions for advice and aid. The progress of the last quarter of a century gives assurance that notable gains in this field will be made during the next twenty-five years. See also VENEREAL DISEASES.

W. F. S.

SOCIAL INSECTS, those insects which maintain a family life in which parent and offspring live together, the younger generation eventually sharing or assuming the labors of the household. In their higher manifestation social insects form huge, usually gynarchic, colonies, domiciled in especially elaborated structures in which many thousands of individuals of all ages reside, the adults differentiated among themselves by the labors which they perform and by correlated differences of size and structure. A host of dependent and semi-dependent organisms often attach themselves to these swarming communities, and the domicile may in instances be connected or quite amicably shared with similar communities of other social insects. The mechanical perfection of such organizations, and the degree to which the interests of the individual are subordinated to those of the

community far surpass that of human society, and render these insects a source of great interest to psychologists, sociologists and biologists. This interest is peculiarly enhanced by the fact that they occupy the evolutionary summit of the invertebrate lines of development, a position only comparable, even if intellectually less exalted, to that enjoyed by mankind in relation to the vertebrates.

The social insects proper comprise the termites, certain genera and sub-families of wasps of the family *Vespidæ*, the ants, certain species of the African bee genus *Allodape*, the sweat-bees (*Halictus*), bumble-bees, stingless honey-bees (*Melipona* and *Trigona*), and honey-bees. Other insects in which the mother remains with the young in a domicile, and continues to feed them, but the young of which do not assume the rôle of nurses, are termed subsocial.

Polymorphism. Almost universally among social insects there are supernumerary castes which are physiologically and usually structurally differentiated from the males and females. Except in termites, they are developed only from females, and are involved in a partial or complete inhibition of the sexual functions.

Trophallaxis. When the larva of a social wasp is approached by a nurse bearing food, it exudes a copious supply of saliva, which is eagerly imbibed by the nurse. So avid are the worker-wasps for this tid-bit that in case it is not forthcoming, they have been observed to forcibly manipulate the heads of their charges until the desired flow of saliva is elicited. This interchange of food is termed Trophallaxis. It is believed to be of primary importance in explaining the mutual relations, not only of larvae and adults in a colony of social insects, but also of those insects with many of their guests and dependents.

Gynarchism. Since the worker and soldier castes of the social insects, except termites, are entirely derived from the female sex, and the queen maintains no consort, the colonies are gynarchies, i.e., controlled by females.

Evolution of Social Insects. Not only have the termites acquired social habits independently from the hymenoptera, but a social organization has independently arisen in ants, and probably several times in wasps and bees. The initial steps of collaboration between the generations are illustrated by the African bee *Allodape*, which nests in hollow stems. In some species the mother-bee lays an egg in the nest, brings in sufficient bee-bread to last the larva from the time it hatches until it is grown, lays another egg above, provisions it with more bee-bread, and so on until the cavity is full. She constructs no partitions between the eggs, as do all other solitary bees, so that the larvae, when hatched, find themselves in company. This intimate contact seems to have been the stimulus that produced the next step in habit-evolution. The female of another group of species lays her eggs together, loose, on the bottom of the nest. She feeds each larva individually, and

continues to feed it until it is grown. The final type shows the advent of efficiency methods, of labor saving practices. The eggs are glued around the side of the chamber. The larvae, nearly of a size, stretch out their heads toward the center, and feed from a common lump, which the mother deposits among them. As they become adult, the young females assist their mother in harvesting the pollen crop, and feeding the brood. Intermediate steps between solitary and primitive social organization are known also among wasps.

Founding a Colony. In temperate zones, winter interrupts the existence of wasp and bumble-bee colonies. Only the fertilized female successfully overwinters, and in spring commences the building of a new colony, attending to all the labors of raising a first brood of workers. Thereafter the latter assume the labors of housekeeping, and the queen no longer ventures from the nest. Colonies of ants and termites, being largely below ground or otherwise protected, are perennial, and may exist for extremely long periods. The usual method of founding those colonies is not dissimilar, except that no period of hibernation intervenes after the nuptial flight. But wasps, bees and more rarely ants in the tropics have a different method of founding a colony, known as swarming. One or a group of fecundated females leave the parent nest in company with a swarm of workers, and set about the rapid construction of a new domicile.

Guests and Dependents. Social wasps and bees have acquired a considerable number of exploiting or parasitic insects of diverse types. But the termites and ants have attracted a legion. The former are called termitophiles, the latter myrmecophiles. They exhibit every grade of relationship from scavenger to pilferer, waylayer and assassin, household guest, cherished pet, and finally internal or external parasite (parasitoid) of individual members of the colony. Others, such as plant-lice and coccids do not exploit the colony, but are themselves exploited for their honey-dew or other secretions, and receive in return protection and sometimes shelter. For additional information on social insects, see articles on ANT, TERMITE, BEE, and WASP. J. C. B.

BIBLIOGRAPHY.—William Morton Wheeler, *The Social Insects, Their Origin and Evolution*, 1928; A. D. Imms, *Social Behaviour in Insects*, 1931.

SOCIAL INSURANCE, the establishment through legislation of a measure of protection for wage-earners against accident, illness, unemployment and dependent old age.

The most universal type of social insurance is accident compensation. Most European countries and all but five American states, Arkansas, Florida, Mississippi, North Carolina, and South Carolina, have enacted statutes providing for insurance payments in case of death, partial disability or total disability which results from an accident occurring during the course of employment. Occupational diseases are also frequently classed as compensatable. Under the American practice, premiums are paid by employers

into either a state fund or private insurance company. The benefits vary greatly; usually not more than two-thirds of the previous wage may be paid. In addition a maximum weekly payment is set which, in the United States, is commonly \$15 a week or less.

Health insurance, despite a long and successful history in Europe, has received but scant support in the United States. This plan, first adopted in Germany, was placed in operation in Great Britain in 1911. Roughly, all wage-earners over 16 are covered by the British plan. The state adds its small contribution to weekly payments of 18 cents for men and 17 cents for women—about half from employers and half from employees. In exchange, free medical care is given by a panel of hired doctors, necessary medicines are furnished, and sickness compensation given. The standard weekly grant is \$3.75 for men and \$3 for women. This compensation begins on the fourth day of incapacitation and only after 104 payments have been made.

Old age pension laws are in force in 17 American states. In Great Britain, protection under a contributory insurance arrangement begins at 65. At the age 70, the obligation is assumed by the government alone. The American practice, where insurance legislation has been adopted, is to provide pensions at either 65 or 70, varying with the state. Such pensions rarely exceed \$1 a day. Despite the opposition of many industrialists, the movement for old age pensions has been met with considerable success.

UNEMPLOYMENT INSURANCE on a compulsory basis has been adopted by most leading industrial countries and now applies to a total of 44 million workers. The British plan, inaugurated in 1911, now provides that a male adult worker pay to the fund 14 cents a week; his employer, 16 cents; while the state's share is 15 cents. Benefits are given through a free public employment exchange system with which each worker is registered. The benefit for an adult male totals \$4.25 a week. Extra grants are made for dependents—\$2.25 for a wife or dependent adult and 50 cents for each dependent child.

Agitation for unemployment insurance in America has centered about two types of bill. The first is the noncontributory type, sponsored by the American Association for Labor Legislation. Under this plan, employers alone make contributions of not more than 1½% of their wage bill to provide unemployment reserve funds which will be set up by industries or groups of industries. Benefits, which will be paid under the supervision of the state, will be at a maximum of \$10 a week; in no case exceeding 60% of the weekly wages. They would continue for not more than 13 weeks. Residential and occupational safeguards are included in the bill.

The second type of bill is that based upon the European model. This provides for contributions by the employer and the employee. Administration and operation of the employment exchanges established under the plan is in the hands of the state.

C. E. W.

SOCIALISM, a belief that the principal means of production and distribution should be owned and operated by governmental authority for public use rather than for private profit. Though agreed on this end, a number of schools of socialism have developed because of differences of opinion as to the speed of transition and the method of its attainment. Chief of these are the Marxian and the Fabian socialists.

Marxian socialism, as a power, began with KARL MARX and FRIEDRICH ENGELS who, in 1848, published the *Communist Manifesto* in which they enunciated the doctrine of the class struggle and the economic interpretation of history, and predicted the rise of a socialist state. Strict Marxians still adhere to the belief that CAPITALISM will soon fall of its own weight and hold that the socialists must be prepared to assume complete control of the mechanism of the political state. A marked controversy has, however, developed within Marxian socialist ranks. The revisionists led by Eduard Bernstein believe that the socialist movement must emphasize contemporary reforms and must be more interested in its immediate growth and in the advance of social legislation than in the final collapse of the capitalist mechanism. Other theorists, such as Kautsky, Hyndman and Boudin have felt that, though Marx and Engels erred in underestimating the strength of capitalism, Marxian theory was, nevertheless, tenable. They pointed to the growth of capitalist concentration, held that crises (*see* CRISIS) were becoming more severe, that the middle class was disappearing, and that a social revolution must be the outcome. The future socialist state is viewed by them as one in which workers will so extend their lines of organization that control can be brought about by the ballot and by economic action. Social reforms are not ruled out but are thought of as incidental to the process of collectivism.

While Marxism spread on the European continent, and in the United States, where it was influenced by the German immigration, Great Britain developed a rival socialist movement. Its name, Fabian socialism, was given it through the activity of the Fabian Society formed in 1883 by a group of British intellectuals. This group later included GEORGE BERNARD SHAW, SIDNEY WEBB (Lord Passfield), Graham Wallace, RAMSEY MACDONALD, JAMES KEIR HARDIE and many others. Repudiating Marxism as being dogmatic and in many essentials inaccurate, the society proposed a less drastic program including the social ownership of LAND; the transfer to the community of such industrial CAPITAL as can be conveniently managed socially; and the compensation of expropriated individuals to an extent as may seem fit to the community. The Fabian Society sought to achieve these ends by the general dissemination of knowledge as to the relation between the individual and society in its economic, ethical, and political aspects.

In a word, then, Fabian socialism wishes encroaching social control and ownership. Leaders of this movement found a ready acceptance of the platform by the Independent Labor Party and were eventually

able to secure the support of the rapidly growing British Labor Party, especially in the years immediately following the World War. In 1919 appeared a program of the Labor Party, toward a new social order, and in 1920 Sidney and Beatrice Webb's book, *A Constitution for the Socialist Commonwealth of Great Britain*. In the program and the book are suggested steeply graduated taxes upon high INCOMES, PROFITS, and inheritances, a steady absorption of rental values by the state, the extension of the sphere of governmental control in mines, public utilities, and heavy industry, and the extension of social insurance protection for workers.

The American socialist movement, long on a Marxian basis, later returned in a more Fabian direction under the leadership of NORMAN THOMAS. It has, however, remained relatively unimportant in American political life.

In the international field socialism is represented by the Second International, allied with which are the 13 million members of the International Federation of Trade Unions. The Second International, antimilitarist in spirit, was dealt a severe blow by the World War and by the withdrawal of the communists (*see* COMMUNISM) in 1918. It has nevertheless persisted. Socialism as a political power has advanced rapidly.

C. E. W.

BIBLIOGRAPHY.—Louis Lorwin, *Labor and Internationalism*; Karl Marx, and Friedrich Engels, *Communist Manifesto*; H. W. Laidler, *History of Socialist Thought*.

SOCIALIST LABOR PARTY, in the United States, the first Socialist party to present a presidential ticket, 1892. An outgrowth of the Social Democratic Workingmen's party founded in 1874, the party adopted its present name in 1877. For 15 years its chief concerns were in proselyting among the foreign born population of the larger cities, and in defending itself against anarchists' attempts to capture the party. In 1886 the Socialist Labor party combined with other elements to support HENRY GEORGE for mayor of New York City, and in 1887 for the governorship of New York. In 1888 the party decided never thereafter to affiliate with any other party, but to support its independent ticket without making compromises or bargains with other factions. From 1892-1916 it regularly nominated a presidential ticket, on platforms fundamentally identical, demanding that the machinery of production and distribution be owned and controlled by the people collectively. In 1920 the party temporarily disappeared, to enter the presidential lists again in 1924 in protest against the "compromise" of the SOCIALIST PARTY in endorsing the nominee of another party, La Follette, an Independent Progressive. In 1932 its nominee, Verne L. Reynolds, polled about 25,000 votes.

SOCIALIST PARTY, the continuation of the SOCIAL DEMOCRATIC PARTY after 1900. During his life EUGENE V. DEBS was preeminent in the party, receiving its nomination for the presidency in 1904, 1908, 1912 and 1920. It has become the major Socialist party in the United States, receiving in each

election a large protest vote as well as the support of the greater number of Socialists. Its largest vote, 901,725, was polled for Debs for president in 1912. In 1924 it endorsed ROBERT LA FOLLETTE, Independent Progressive. In 1928 its presidential nominee, NORMAN THOMAS, received 267,420 votes, 107,332 in New York State alone. Its political demands call for many democratic innovations, including the abolition of child labor, establishment of minimum wages, protection of migratory and unemployed workers, direct popular election of the President, and abolition of the power of the Supreme Court to pass on the constitutionality of acts of Congress. Its industrial demands are for "complete reorganization of our social system, based upon public worship of public necessities." Norman Thomas, nominee again in 1932, polled about 1,000,000 votes.

SOCIAL PSYCHOLOGY, a science dealing with the social behavior and social consciousness of the individual. "Social behavior" and "social consciousness" are relative terms. Most individual behavior and individual consciousness are in some sense social. The emphasis here is placed upon the social aspects of individual consciousness and behavior. The terms are applied to the individual because it is only in and through the individual that group phenomena exist. Such terms as "group consciousness," "group mind" and "group behavior" may be used somewhat figuratively but are misleading as scientific concepts. The terms are very easily subject to a metaphysical interpretation, whereby the erroneous impression is conveyed that group mind and group consciousness are entities existing apart from the individuals who compose them.

In its early days social psychology dealt largely with crowd and mass phenomena. To a great extent attention was centered on the peculiar manifestations of imitation, sympathy and suggestion. Such things as group fashions, panics, hysterics and other forms of crowd behavior were studied in particular. Although these are important subjects for social psychology, much more attention is now given to the development of the social self in the individual, and the normal and common processes of interstimulation between individuals and groups; and to the interaction between the individual and the group. This includes language and communication, cooperation and understanding, and the adjustment of various types of conflict. Social psychology studies individuals in their social aspects; sociology is the science dealing with groups as such.

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SOCIAL REFORM. Following periods of great economic and social upheaval with the consequent suffering they bring to the unfortunate classes of society, movements and programs for social reform have always cropped out. They have attempted to remedy organic defects in society by organic changes. This process occurred after the commercialization of Athens, the plutocratic development of the Roman

republic, the disintegration of feudalism, and more recently, following the INDUSTRIAL REVOLUTION.

During the 18th and up to the middle of the 19th century many programs for social reform were advocated. The LAISSEZ-FAIRE theory (economic liberalism) in France, utilitarianism in England, numerous brands of socialism throughout Europe and philosophical anarchism did little but prepare the way for the modern movements. The outstanding leaders during this era were Quesnay, ADAM SMITH, Jean Baptiste Say, von Humboldt, Bentham, JOHN STUART MILL, Sismondi, Saint-Simon, Thompson, Lasalle and Godwin. Individualism was extolled, free trade established in many countries, serfdom almost entirely wiped out, factory legislation discussed in England and a free public education system maintained in Prussia. Although the middle classes of Europe were gaining some political powers, democracy was still non-existent.

The advent of Darwin's theory (see C. R. DARWIN) of evolution, the rapid and extensive spread of industrialism, gaining adherents for the cause, Kantian and Hegelian idealism, stressing the supremacy of the state over the individual and thus opening the way for reform carried on by the state, and the establishment of a scientific sociology, producing scientific programs of reform, served as potent factors in the development of this movement during the latter half of the 19th century.

This period witnessed some further brands of socialism: Marxian, Fabian, Revisionist, State, Christian and Guild. Marxian socialism is the most uncompromising of all. Stressing the economic interpretation of history, it insists upon the unending hostile conflict between the proletariat and capitalism. Fabian and Revisionist Socialism are modifications of Marxism and propound the belief that social reform can be carried on by the state. State Socialism advocates state ownership of public utilities; Guild Socialism attempts to solve difficulties by modernized medieval guilds; and Christian Socialism has formed organizations for the economic betterment of the workers and aided in establishing workingmen's parties.

The rise of anarchism has furthered the development by pointing out the evils manifested in capitalistic government. Syndicalism urges a class war against capitalism conducted through industrial unions by means of sabotage and general strikes. Trade unions, while offering no permanent remedy, have greatly alleviated the position of the workingmen and have occasionally prevented violence by insisting upon arbitration of labor disputes. The SINGLE-TAX on land, is a solution proposed by Henry George. By the nationalization of land, i.e., giving to the government the unearned or social surplus in land values, he believed that poverty would be abolished. Solidarism, rising in France, is an attempt to create better conditions for the laborer while maintaining the capitalistic order.

The World War produced a number of alarming challenges to capitalism. Russia changed from a

monarchy to Marxian socialism and in Germany Revisionist Socialism was triumphant in the political combat. Capitalism, fearful of its position, retaliated by imprisoning radicals, instituting espionage laws and in general insisting upon the synonymity of patriotism and capitalism.

The outcome of this turmoil is still uncertain. Some recognize in Communism the order of the future, others maintain that the rule of big business is at the threshold. The progress of social reform, however, depends upon disarmament and a radical change in the imperialistic designs of nations.

SOCIAL SERVICE EXCHANGE, THE, also known as Confidential Exchange and Central Index, one of the most potent factors in the promotion of efficiency and cooperation in social work. The central feature is a catalogue of identifying information regarding each social agency irrespective of method of support or the race or creed of its clients. By consulting this catalogue a worker may know what other agency has previously been in touch with the same client, and has available knowledge concerning him. The Social Service Exchange carries no history or treatment facts. Its purpose is to show where such facts may be found.

The form of Social Service Exchange, which exists in every city having a social conscience and well defined social program, originated with the Boston Associated Charities over 30 years ago. In the beginning the chief purpose was to prevent duplication of relief; a later emphasis was placed on the promotion of economy and efficiency. The **SOCIAL WORKER** of to-day emphasizes the opportunity thus afforded for exchange of experience and information. The Social Service Exchange as a central index of the records of the social agencies, makes available for all an accumulation of material valuable not only in the individual case, but in various research projects. B. E. H.

SOCIAL SETTLEMENTS, agencies of practical social research and experiment. They undertake no form of service already carried on by public or private organizations. Their staff of professional men and women live in tenement neighborhoods to devise ways of meeting hitherto unrecognized needs of working people, and to create opportunities for the expression of their powers.

Toynbee Hall, London, the first settlement, was established by Samuel A. Barnett in Dec. 1884. University Settlement, New York, the first American settlement, was founded in Aug. 1886, by Stanton Coit. The 200 settlements in the United States are mostly located in cities.

Settlements helped secure labor laws to protect women and children, to establish the Federal Children's Bureau and obtain mothers' pensions, reduction of sweatshops, old age pensions: public health nursing, infant welfare clinics, mental hygiene for children, municipal playgrounds, baths, gymnasiums, school and recreation centers, the first school nurses, visiting teachers and vocational counsellors in public schools.

Settlement music schools, little theaters, local art museums and schools, handicraft guilds, play schools, summer camps and other educational recreation enterprises a generation in advance of public policy, are now being developed.

A. J. K.

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SOCIAL VALUE, THEORY OF. The theory of social value holds that though values of all kinds are not intrinsic in objects but rest ultimately in human minds—are psychological and not physical phenomena—they do not rest in the minds of individuals thought of separately, but are, rather, primarily social in character, the product of many minds in organic interplay. Economic values are merely one species of aspect of the whole genus of social values, a genus which includes, legal, moral and aesthetic values. While economic value is not inherent in goods, not independent of the minds of man, it is a fact which is in large degree independent of the mind of any given man. To a given individual in the market, the economic value of a good is a fact as external, as objective, as opaque and stubborn, as is the weight of an object or the law against murder. Moreover, everything in the individual mind, including the individual's scale of values, has been influenced by processes in the minds of others. The individual monad is a myth. His machinery of thought—language and logic—is socially given him, his ideals and interests, his tastes even in matters of food and drink, are socially given. In brief, the minds of individuals are in such intimate interrelation that they may be said to constitute one greater mind, a Social Mind. This is in no sense to imply that there is a social oversoul that transcends individual minds, but merely that men's minds function together in an organic unity.

The social value theory has been particularly important as applied to the problem of the value of money. The theory of the value of money is merely a special case of the general theory of value. Economic value may be most simply viewed as a tertiary quality common to goods. This common quality is also a quantity: it belongs to that class of qualities, like weight, length, and warmth, that can be greater or less, and can hence be given exact mathematical statement, like the weight of a man or the price of an object. The value of money, like the value of goods, is not a ratio of exchange for a ratio of exchange is the reciprocal relation of two absolute values. The value of money, therefore, is to be distinguished from the reciprocal of the price-level or the purchasing power of money. Individual prices have two cooperating causes, the value of the money-unit, and the value of the unit of the commodity in question. Particular prices and the general price level may change, therefore, either because of changes in the value of money or because of changes in the value of goods; these are not merely two ways of saying the same thing.

The social value theory of money is to be sharply

distinguished both from the QUANTITY THEORY and from the metallist or bullionist theory. As opposed to the first, it holds that though the quantity of gold is a highly important factor in determining the value of gold standard money—just as the quantity of any commodity is highly important in determining its values—there is no exact inverse ratio of the quantity of money, or quantity multiplied by velocity of Circulation, to the value of a given unit of money, such as the quantity theory asserts. The social value theory also holds that particular or general prices may rise or fall without any antecedent change in the quantity of money. It holds, further, that with normal conditions of gold convertibility and a modern banking system, changes in the volume of bank notes and deposit currency more often follow and are caused by changes in the price level than vice versa. The value of fiat paper money, it points out, fluctuates not alone with changes in the quantity of that money, but with public sentiment or any sort of political development that affects the ultimate prospect of redemption or conversion into gold, or the specific rate at which redemption or conversion may be made—a type of fluctuation for which a strict quantity theory permits no explanation. As against the bullionist theory, the social value theory holds that the whole value of money cannot be explained by the value of gold bullion, conceived of as a mere commodity. Money, in general, gets part of its value from its monetary employment. But as against the quantity theory, the social value theory holds that the money service presupposes the existence of value for money from some source other than the monetary employment; hence the monetary employment at best can explain only a differential portion of the value of money. The social value theory of money, in brief, in attempting to take all the complex social factors into account, necessarily lacks simplicity.

H. HA.—B. M. A. Jr.

BIBLIOGRAPHY.—B. M. Anderson, Jr., *The Value of Money*; G. H. Cooley, *Social Process*.

SOCIAL WAR, the name given to the struggle between Rome and her Italian allies between 90 and 88 B.C. This crisis was precipitated by the law passed under the consulship of MARCUS LICINIUS CRASSUS and M. Scaevola in 95 B.C. The law had reference to Roman citizenship and became much more exacting with reference to showing credentials. The Italian allies, known as *socii*, naturally resented this, for they had been struggling for years to gain their rights as Roman citizens. Hence they banded together and formed an alliance against Rome, known as Italia, with a capital at Corfinium. Among the peoples engaged in the struggle were the Samnites, Marsians and Lucanians. Because of the leadership displayed by the Marsi, the contest is sometimes known as the Marsic War. Rome offered citizenship to the faithful and thus undermined the union of the *socii*; but the allies thus gained their end and were absorbed into the body of Roman citizens.

SOCIAL WORK, RELIGIOUS. See RELIGIOUS SOCIAL WORK.

SOCIAL WORKER, one who acts as agent in any social program of relief or amelioration, either privately or publicly supported. It is estimated that, in the United States, there are 30,000 men and women employed as staff members of philanthropic agencies. There are 29 recognized schools offering varied types of training for social workers in the work of relieving destitution and distress among the less fortunate classes. Some offer work in psychiatric analysis and treatment. The work offers about the same prospects as teaching, and is particularly suited to the abilities of women. See also SOCIAL SERVICE EXCHANGE.

W. M. W.

SOCIETY ISLANDS, a group of French islands in the South Pacific Ocean. The largest of the group is TAHITI, covering an area of 600 sq. mi. The next largest is Moorea, covering 50 sq. mi. They are mostly of volcanic origin and have a healthful climate. Phosphate, the annual production of which averages 80,000 metric tons, is the chief product. Various tropical fruits are cultivated and exported. Papeete, on Tahiti, is the capital. In 1926 the pop. of Tahiti was 8,585 and of Moorea, 1,837.

SOCIETY OF COLONIAL WARS, a patriotic society, founded in 1892 in New York state with the object of perpetuating the names and brave deeds of those who took part in the American colonial wars. Membership is open to those who are male descendants of colonial officials, officers, and men in the colonial army and also to British officers and men who served with the colonists. The society confines its attention to the period between the landing at Jamestown and the battle of Lexington.

SOCIOLOGY, the science concerned with the phenomena of society. Like the other social sciences it had developed in the first quarter of the 20th century through a half century period of changing emphasis and methodology. The term sociology, starting in Europe perhaps a little before 1850, came to be used in America a quarter century later by W. G. SUMNER at Yale. From that time on sociology in America developed as a separate science around college and university departments of instruction in contradistinction to the European development around scholars and isolated efforts. The early leaders in America were Lester F. Ward, W. G. Sumner, Franklin H. Giddings and Albion W. Small whose work in turn had been greatly influenced by the work of the Europeans, A. COMTE, H. SPENCER, J. S. MILL, G. Tarde, W. Bagehot, as well as C. DARWIN, F. GALTON and others. The development of sociology was early integrated in America in two ways. One was the writings of Giddings, Small, Sumner and Ward, first, and Cooley, Ross and other sociologists later on, in which sociological theory was presented through unified systems, elements and principles. The other was the continuing development from the '90's of departments of instruction, increased interest, and the formal organization of the American Sociological Society in 1906, together with the adoption of the *American Journal of Sociology* as the official

organ of the Society. In harmony with the generally recognized leadership Ward, Sumner, Giddings and Small were the first presidents and each was honored with two years of the presidency. From the first meeting in 1906 with a membership of 115 the American Sociological Society has grown steadily until at its 25th anniversary of 1930 it recorded a membership of 1,812 and had the largest attendance of any previous meeting.

The changing meaning and applications of sociology may perhaps be best shown by an examination of the development of the subject. In America an examination of more than 1,500 papers read at the 25 annual meetings and published in various places showed striking contrast between the earlier sociology and current sociology of the 1920's. Whereas the earlier papers were devoted largely to the theoretical study of society and arguments and presentations of general theory, later emphasis has been upon more specialized fields and objective research. The order of preference in the earlier meetings seems to have been political theory, war and conflict, race and ethnic groups, biosociology, social policy, the development and teaching of sociology and the challenge for unity and scientific methodology among sociologists. The later papers conforming to sectional and divisional units of the annual programs of the Society emphasized in order of total participation, rural sociology, the community, social research, social work, sociology of religion, the family, social psychology, educational sociology, statistics and biological factors.

This changing subject matter and approach reflects current sociology as a science of society which comprehends the study of the totality of human relationships. It studies the primitive culture but more and more it emphasizes contemporary society and culture, neglecting no special aspects of human relationships and organization which are primarily social as opposed to the special and technical economic, political, psychological, biological, anthropological and historical aspects. Thus an examination of the literature of sociology of to-day reveals a wide contrast between the earlier days with a few texts and learned articles by the masters and the present literature with scores of books, series of textbooks, and hundreds of articles and monographs. They feature population and vitality; cultural backgrounds as reflected in anthropology and cultural sociology; race and ethnic groups; the Negro and Negro problems; social psychology and behavior problems; educational sociology; rural and urban sociology; the family and its problems; crime and its treatment; general social problems; special social problems and social pathology; human ecology; folk and regional sociology; social change; social statistics; sociological methods; with a considerable recurring emphasis upon the philosophical foundations and the history of social theory in which more than a thousand European and American students, theorists and philosophers may be listed.

One of the best indications of the general trend of sociology from a philosophy of society to a science

of society is found in the 30 research projects undertaken by the three-year plan of the President's Research Committee on Social Trends begun in 1929, the most comprehensive sociological research up to then undertaken. These include mechanical inventions and scientific discoveries as causes of social change; economic organizations and their social consequences; communication, mobility, and the dissemination of news; population trends; utilization of land and natural resources; education; social attitudes; racial and ethnic groups; vitality of the American people; the changing family; women in occupations; politics and other activities outside the home; the child and youth; occupation and the unoccupied; labor and labor groups in a changing rôle; religious organizations; associations, leisure time activities and recreation; arts and social change; consumption habits; rural life; urban problems; society's offenders; law and legal institutions; social work and philanthropy; public welfare; public health and medicine; public administration; extension and distribution of governmental functions; trends in governmental expenditures and taxation; social trends in relation to governmental trends; the application of the social sciences to society's problems; statistics and social source materials.

European sociology, unlike American, grew up around the work of individual scholars—philosophers, scientists and students. The works of the European sociologists, however, may be said to have given the chief stimulus to American sociology in the earlier days. In America the trend of sociology has persistently been away from its original moorings, both in content and methodology, on the one hand, and in organization in universities and colleges, on the other hand. In Europe, however, the development of sociology still tends to conform to the earlier pattern in which scholars do research and write on sociology although perhaps not always designated as sociologists. Especially have they made contributions toward behavior problems and psychoanalysis, social psychology, human biology, statistics, economic structure and general philosophy and analysis.

H. W. O.

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SOCIOLOGY, EDUCATIONAL, a branch of sociology which has recently emerged as a professional study for teachers and other educators, somewhat analogous to educational psychology and history of education.

In general it seems to be true that just as the science of educational psychology tends towards analytical study of the rooted characteristics and learning potentialities of individuals, so educational sociology tends towards procuring realistic interpretation of the needs of societies for particular kinds of education.

The National Society for the Study of Educational Sociology, founded in 1927, published in 1928, as its first yearbook, a general bibliography of books and articles falling within the scope of educational sociology as defined by the society. D. S.

SOCRATES (469-399 B.C.), Athenian philosopher, was born at Athens about 469 B.C. His father was a stone-mason and his mother a midwife, and for a while Socrates followed in the footsteps of his father and became a sculptor. But he soon abandoned his art and took up the study of philosophy through the practical method of human contacts in the market place.

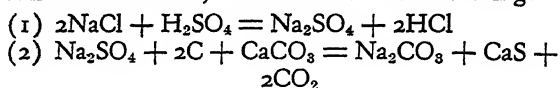
In his earlier years Socrates seems to have studied the writings of the older philosophers such as Empedocles, Anaxagoras and others of the Ionic school. He also imbibed elements of the Orphic and Pythagorean cults and became acquainted with such sophists as Parmenides, Zeno and Protagoras. His method was to cross-examine in public places some exponent of a theory current in philosophical circles and by this logical and analytical cross-examination to determine the truth of the contentions. Thus was developed the famous Socratic method and Socratic dialogue. Socrates gradually gathered around him a band of devoted and enthusiastic young admirers and disciples, among the most famous of whom were Critias, Alcibiades, Xenophon and Plato. Socrates had taken part in the campaigns of the Peloponnesian War where he displayed unusual courage, and the political contacts made at this time identified him with the aristocratic party at Athens and brought him into disfavor with the democratic faction. At the age of 70, consequently, Socrates was brought to trial ostensibly for impiety and was condemned to death. He died by drinking poisonous hemlock in an Athenian prison in 329 B.C. His trial and death were immortalized by Plato in the famous *Apology* and the dialogue entitled *Phaedo*.

The initial propulsion in the thought of Socrates is found compressed in two sentiments that he loved to repeat. The first was the agnostic affirmation: "One thing only I know, and that is that I know nothing." The second was the psychologic maxim: "Know thyself." These agnostic and psychological prepossessions of Socrates steered Athenian philosophy definitely away from the previous preoccupation with the nature of external things towards intensive studies in the fields of ethics and politics culminating in the supreme supplementary systems of PLATO and ARISTOTLE. In particular the contribution of Socrates to the evolution of his successors lay in the pregnant doctrine that the good and the intelligent are identical concepts and that virtue is synonymous with wisdom. From this it was an easy step to Plato's doctrine: "Until philosophers are kings—cities will never cease from ill, nor the human race." R. N. B.

SOCRATIC METHOD, the method used by SOCRATES in developing the meanings of concepts. It consists of two parts known as the Socratic irony and Socratic induction. The first part is largely negative

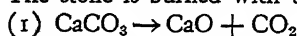
in its function. Socrates uses it to reduce the ideas advanced by his victim to absurdity before he proceeds with the argument at hand. The second part of the method consists in building up the meaning of the concept and is more positive in its function. Throughout the discussion proceeds according to the question and answer method. For instance, Socrates asks whether the breath is hot or cold. If his opponent says it is hot, Socrates asks why, then, one uses it for cooling soup; if his opponent says it is cold, Socrates at once demands why it is that one can see his breath on a cold day. In the course of the discussion it will then develop that the breath is hot or cold only in relation to that with which it is compared. The Socratic method is best illustrated in Plato's *Dialogues* and is often used in teaching; only a clever teacher, however, can use it with any degree of success. See PLATO.

SODA, a general term used to include baking soda, washing soda or soda ash (sodium carbonate), caustic soda and sodium bicarbonate. Soda ash may be manufactured by the Le Blanc or ammonia soda process. In the Le Blanc process, salt, sulphuric acid, coke and limestone are used, the chemical reactions being:



Both reactions are carried out by application of heat. The soda is lixiviated from the insoluble calcium sulphide, and evaporated to dryness. The calcium sulphide can be reconverted to sulphuric acid.

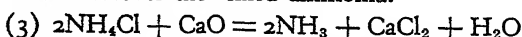
At present over 95% of all soda is made by the ammonia soda process from salt, limestone and coke. The stone is burned with the coke.



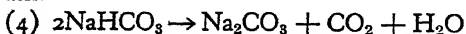
The carbon dioxide is absorbed in ammoniacal brine in Solvay towers:



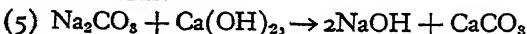
About 70% of the NaHCO_3 is precipitated as crude soda and filtered. The filtrate is heated to decarbonate it (reaction 2 reversed) and then treated with milk of lime to recover the "fixed ammonia."



The crude NaHCO_3 is calcined to produce "light ash."



All recovered ammonia and carbon dioxide are used cyclically in process. A large portion of soda ash goes into the manufacture of CAUSTIC SODA by decomposition with lime:



Soda is found in nature as thermonatrite, and in natural brines as at Searles and Owens Lakes, Cal., and at Wadi Naturun, Egypt, from which it is recovered by crystallization. Soda also is found in the ash of many plants and is known as "barilla."

Soda is used in the manufacture of glass and soap, also in petroleum refining, the manufacture of sodium salts; pulp and paper; water softening and textiles.

Sodium bicarbonate (NaHCO_3), is made by carbonating a solution of sodium carbonate from which it crystallizes. It must be dried in a current of carbon dioxide. It is used in effervescent salts and beverages, baking powder, as a reagent in analysis, in gold plating, tanning, treating wool and silk, and medicine.

Sal Soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$), is made by crystallizing a soda solution below 33°C .

Sodium sesquicarbonate or trona ($\text{NaHCO}_3 \cdot \text{Na}_2\text{CO}_3 \cdot 2\text{H}_2\text{O}$) is made by partial carbonation of a soda solution above 26°C . Sal Soda and trona are used chiefly as washing compounds. R. B. M.

SODA WATER. See SOFT DRINKS.

SODDY, FREDERICK (1877-), British chemist, was born at Eastbourne, Sept. 2, 1877. He was educated at Merton College, Oxford, and studied under SIR ERNEST RUTHERFORD and SIR WILLIAM RAMSAY. In 1900 he became demonstrator in chemistry at McGill University, Montreal, in 1904 lecturer in chemistry and radioactivity at Glasgow, professor at Aberdeen in 1914, and professor at Glasgow in 1919. Widely recognized as an authority upon radioactive elements, he was elected to the Royal Society in 1910 and received the Nobel Prize in Chemistry in 1921. He wrote a number of works upon radioactivity, including, *The Chemistry of the Radio Elements and the Periodic Table*, 1914; *Matter and Energy*, 1912; and upon more general subjects, including *Science and Life*, 1920, *Cartesian Economics*, 1922, *Inversion of Science*, 1924, *Wealth, Virtual Wealth, and Debt*, 1926, *The Wrecking of a Scientific Age*, 1927.

SÖDERBERG, HJALMAR EMIL FREDRIK (1869-), Swedish novelist and short story writer, was born at Stockholm, June 2, 1869. His books of short stories include *Storiettes*, 1898; *Strangers*, *The Road Grows Dark* and *The Accomplished Dragon*. Among his novels are *Aberrations*, *Martin Birck's Youth*, *Doctor Glas*, 1905, and *The Serious Game*. He is the author also of several plays and a few volumes of philosophical and religio-philosophical essays.

SODIUM, an alkaline metallic element comprising two-thirds of the solid matter of sea water and about $2\frac{1}{2}\%$ of the earth's crust. It is a soft metal with a silvery luster, whose symbol is Na, atomic weight 22.997, and melting point 96°C . On exposure to the air it tarnishes rapidly with the production of a greenish phosphorescence. Sodium is obtained by the electrolysis of the fused hydroxide. It is used in the manufacture of sodium peroxide and many carbon compounds used as drugs and dyes. Sodium chloride is the common salt used daily by everyone.

The principal salts of sodium are as follows:

Sodium Borate. Colorless, transparent crystals or a white powder; formula $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$, also known as sodium tetraborate, sodium pyroborate, borax. It is soluble in water but insoluble in alcohol. Sodium borate should not be taken internally, as the continued ingestion of even small doses may cause deleterious effects. It is useful as an external antiseptic and is used in dilute solutions as an eye wash.

Sodium Carbonate. See SODA.

Sodium Chloride, or common salt (formula NaCl), is a colorless crystalline powder, occurring in natural deposits or derived from sea water. (See SALT.)

Medicinal Uses. Sodium chloride is the chief inorganic constituent of the blood; hence it is much used for preparation of "physiologic solution of sodium chloride," i.e., a solution containing 8.5 gm. of sodium chloride to 1000 c.c. of distilled water, which is approximately the same salt concentration as that of blood. This solution is used for introducing large quantities of water into the system more rapidly than could be done through the alimentary tract, as in cases of severe hemorrhage, surgical shock, or in severe dehydration after violent purgation arising from poisons. When given by mouth in large doses, sodium chloride is an emetic and, in proper dilution, laxative. Excessive use as a seasoning for foods may be harmful in certain kidney diseases (nephritis).

Sodium Nitrite (NaNO_2). For medicinal properties, see AMYL NITRITE.

Sodium Phosphate. See under PHOSPHORUS.

Sodium Sulphate ($\text{Na}_2\text{SO}_4 + 10\text{H}_2\text{O}$) or Glauber's Salt. It occurs as large colorless prisms or granular crystals, odorless and having a bitter taste; freely soluble in water and practically insoluble in alcohol. It is used as a saline cathartic but is less agreeable than magnesium sulphate or sodium phosphate. It is the active ingredient of Carlsbad Salt.

SODIUM AND POTASSIUM TARTRATE: As a purgative. See CATHARTICS.

SODIUM BROMIDE, white cubular crystals or white granulated powder, NaBr , odorless and with a saline, bitter taste, freely soluble in water. Sodium bromide is used as a nerve sedative and to relieve convulsions, such as those due to epilepsy; it is also useful for quieting nervous excitability, for neurasthenia, and hysteria. It is a common ingredient of epilepsy nostrums and also of remedies for sea sickness.

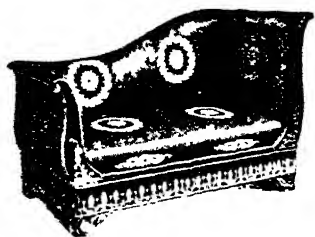
SODIUM PHOSPHATE: As a purgative. See CATHARTICS.

SODIUM SULPHATE: As a purgative. See CATHARTICS.

SODOM AND GOMORRAH, two cities mentioned in the Bible in the vicinity of the Dead Sea which were destroyed because of the evil life of the people. Of all the inhabitants who perished from the fire and brimstone which fell from the skies, only Lot and his family escaped. His wife, disobeying the injunction not to look round at the flaming city, was turned into a pillar of salt. Jesuit archaeologists of the Pontifical Institute of Rome, working on what is generally considered the site of the ancient towns, in 1932 unearthed mural paintings which are believed to be the oldest type yet found in Mediterranean countries, possibly excepting Egypt. Pottery marked with a crude alphabet was also discovered, showing that the inhabitants had a primitive written language.

SOFA, a long seat on which to sit or recline, having a back and arms and generally upholstered. An early

traveler in the Orient speaks of the dais on which the Grand Vizier sat as "a sofa spread with very sumptuous carpets of gold." The first use of the word in the modern sense occurred in the 17th century, when the splendidly designed sofa, richly upholstered with



SOFA IN THE FRENCH EMPIRE STYLE,
19TH CENTURY

silks and velvets, was evolved from the elaborately carved Italian *cassapanca* or chest-bench. The changing styles of chair construction and decoration were naturally reflected in the sofas. Among the most admired products of early American designers are the "lyre sofas" of DUNCAN PHYFE.

SOFIA, capital of the Kingdom of **BULGARIA**, and seat of the district of Sofia, situated on the Bogana River in a wide plain between the Balkan range to the north and Mt. Vitosha to the south, and occupying the most central position of all important cities in the Balkans. It is connected by direct railways with Constantinople, Belgrade, Salonika and Bucharest. For four centuries before 1878 it was the residence of a Turkish governor-general of the Balkan peninsula. When Bulgaria was delivered from the Turkish yoke in 1878 Sofia was chosen as the capital of the new state. It has since been completely rebuilt and has wide streets and boulevards, new sewers, electric light plants, electric trams, modern office buildings and receiving and broadcasting radio stations.

In Turkish days Sofia had over a hundred mosques, only one of which, the Banyabashi Djamia near the central bathhouse in the business district, remains open and is used by Muslim worshippers. The Buyuk Djamia, or Great Mosque, with its nine metal cupolas, but with its minarets sawed off, is now being used for the premises of the Bulgarian National Museum. Upon the site of the Turkish *konak* stands the palace of King Boris, built by Alexander Battenberg and improved by his father the former King Ferdinand. The Alexander Nevsky Cathedral erected at the beginning of the 20th century, as a memorial to the Russians fallen in the War of Liberation, is the largest and most beautiful Orthodox church outside of Russia. The Cathedral of Sveti Kral in the hub of the capital was dynamited by revolutionists in 1925 but has since been rebuilt. Sofia is the industrial, commercial and cultural as well as the political capital of the kingdom. The industry embraces lining and silk weaving, tanning

and brewing. Soap, sugar, paper, and spirits are manufactured. The trade is chiefly in agricultural products. The free and state universities are located here, and there are German, Italian and American schools. Nearby at Simeonov is the new American College. The National Theater, supported by the state and maintaining play and opera stock companies, is one of the most beautiful and best equipped in Europe. The Royal Zoological Gardens, the Boris Park and the modern bathing houses in the suburb of Banki are the result of the efforts of the former King Ferdinand to beautify the city.

Founded by the Roman emperor Trajan and a favorite residence of Constantine the Great, Sofia, or Serdica as it was then called, was burnt by the Huns and later captured by the Bulgars under Krum in 809. The Bulgarians called it Sredetz, from Slavic *sreda* (center), but the Byzantines captured it and renamed it Triaditza. From that time it was alternately Byzantine and Bulgarian until the Turks captured the city in the 14th century. Except for brief occupations by the Hungarians in 1443 and by the Russians in 1829, the Turks held it until 1878 when the Russian army under General Gurko redeemed the city for Bulgaria. Pop. 1926, 213,162; 1931, 356,972.

SOFT DRINKS contain no intoxicants. Beverages without carbon dioxide do not effervesce, but are still. They depend for zest and palatability on a high percentage of acid and flavor.

Soda water is the basis of the bottling industry. It is the carbon dioxide which gives the zest and sparkle to the beverage and its bactericidal action tends to prevent spoilage. Carbon dioxide is dissolved under pressure in cooled, filtered water and filled into bottles containing a fixed amount of flavored syrup as they are delivered on an automatic feeder from the washing machine. They are then capped. The syrup is usually a 60% sugar solution to which has been added the flavor or extract, color and acid.

Flavor is the most important constituent of soda water and is usually obtained from **EXTRACTS**. In orange, lemon and lime soda water the respective oils, expressed from the peel, are dissolved in alcohol and water is added in successive stages until the insoluble constituents are precipitated at about 50% alcohol content. In ginger ale, extracts of Jamaica and African ginger are blended with lime extract and tempered with spices. Capsicum makes it hot. Less sugar and more acid makes the "dry" type, some of which contain little sugar. Cream soda is vanilla sometimes fortified with vanillin or **COUMARIN**. Oil of wintergreen and sassafras are the principal flavors in root beer, birch beer and sarsaparilla. Methyl anthranilate is the basis of grape flavors and the berry flavors are mostly synthetic. All of the synthetic flavors are harmless and some think them superior in flavor to fruit juices. The bottler can use fruit juice only where quick turnover is assured because carbon dioxide is not a reliable preservative against the micro-organisms which destroy fruit juices. The

average $6\frac{1}{2}$ to 8 oz. bottle of soda water contains about 1 oz. of sugar and $1\frac{1}{4}$ oz. of carbon dioxide.

The clerk at a soda fountain can use "juice" flavored syrups. A measured amount is "thrown" into the glass, which is then filled with carbonated water, the plain soda. The addition of ice cream makes the "ice cream soda"; the opportunities for variety are endless. Crushed fruit, whipped cream, eggs, malt may be added until the "soda" becomes a meal in a glass.

Sterilized milk chocolate in bottles approximates the home made cup of cocoa. Heated to 242° F. in a sterilizer, the sealed bottle keeps indefinitely. It is the most nourishing of bottled drinks and contains carbohydrates, fat and proteins. An 8 oz. bottle yields about 144 calories, approximately the fuel value of two eggs. *See also* BEVERAGES. F. M. B.

SOFT GROUND, an ETCHING process, the *verniss mou* of the French, which produces broken lines not unlike those of a chalk or pencil sketch. The plate is coated with a half-and-half mixture of ordinary etching ground and soft tallow. Over this is laid grained paper, on which the artist draws his design in pencil. When the paper is lifted, the adhesive ground comes away with it along the lines, leaving the copper exposed. The lines are then bitten with acid as in ordinary etching. Modern exponents of soft ground etching are MARY CASSATT, Charles Mielatz, James D. Smillie and Felicien Rops.

SOGDIAN, an extinct Middle Iranian language of the INDO-IRANIAN linguistic group formerly spoken in Russian Turkestan and extending to Manchuria. Its literature, written in an ARAMAIC alphabet, is mainly Buddhist, with some Christian and Manichæan documents, and dates chiefly from the 8th and 9th centuries. It seems to be represented by the modern Yaghnobi, spoken in a small area in the valley of the Yaghnob, an affluent of the Zerafshan.

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SOHO, a district east of PICCADILLY, in London, England, noted for its foreign population, mostly French and Italian, and its Continental atmosphere. The quarter, which was a favorite refuge for emigrating Huguenots after the revocation of the Edict of Nantes, retains many of its 17th-18th century houses.

SOHRAB AND RUSTUM, a Persian legend in blank verse by MATTHEW ARNOLD; published 1857. This simple, intensely moving poem tells the following story. Sohrab, the natural son of Rustum, is so mighty a warrior that he spreads terror among the ranks of the Persian army. He challenges Rustum, greatest of the Persians, to single-handed combat. For two entire days the two brave men fight, using all their strength and skill. At last Sohrab is mortally wounded, and then only does Rustum, the victor, perceive that his dying foe is his own son.

SOIL, the superficial covering of the earth, composed of fine particles produced by the gradual crumbling of rocks and disintegration of organic matter. Frequently soil overlies the materials which produced

it, and is called sedentary. In other cases, wind, water or glacial action has removed the soil and deposited it in new environment, when it is classified as transported. In the United States, the soils of the Piedmont Plateau, Appalachian Mountains and plateaus, and limestone valleys and uplands are sedentary soils, otherwise known as residual. Loess, a very fertile and largely wind-laid soil, is found extensively in the central United States, including the greater part of Iowa and Missouri and in Illinois, Kentucky, Tennessee and Mississippi, extending into parts of Nebraska and Kansas. Along the St. Lawrence Valley and the Great Lakes and extending into North Dakota, Minnesota and Wisconsin are transported soils of glacial origin. Along the lower Mississippi River in the delta country is an important example of alluvium, or river-transported soil. Colorado, Nebraska and Montana contain examples of ash soils, formed from the accumulated lava of extinct volcanoes. These, like similar soils in Italy and Hawaii, are extremely fertile.

The proportion of mixture of three chief constituents makes a soil fertile or otherwise. These constituents are sand, clay and humus. Sand is almost pure silica. Too much sand makes soil loose, unable to hold water and therefore unsuited to plant growth. Clay is present in a good soil in fair amounts; agriculturally, the term applies to a sticky substance made up of fine particles of decomposed rocks which when wet cleaves together and when dry bakes hard, becoming impervious to the passage of air or water. Humus is the result of decomposition of animal and vegetable matter; it is found in excess in swampy lands, and peat is the leading example of concentrated humus. Humus holds water well, but in too great quantity is acid and does not support plant roots. In practical agriculture, soils are grouped as sandy, loamy (a combination of sand and clay in nearly equal proportions), clayey and peaty. They are also called light and heavy, a sandy soil being light and a clayey one, harder to till, heavy.

Other important constituents are the mineral salts such as potassium, carbon, sodium, phosphorus, calcium and nitrogen, which plants require for healthy growth. Soils deficient in these minerals may be treated with manure or commercial fertilizer to supply them, but a completely worn out soil cannot be restored without long rest and treatment.

Of late years it has been recognized that soils contain many bacteria, some of which are beneficial and some harmful. These minute organisms help the soil to appropriate from minerals and fertilizers elements, especially nitrogen, essential to plant growth. Nitrogen-producing bacteria grow especially on the roots of leguminous plants, which explains the reason for "green manuring," that is, the growing and plowing under of such crops as clover, alfalfa and soy beans.

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SOILING CROPS, for animal feeding. *See* ROUGHAGES.

SOIL SAVING DAMS—SOLAR ELECTRICITY

SOIL SAVING DAMS, dams which impede the flow of water through gulleys and cause silt to be deposited in the pool above the dam and prevent erosion of the soil. Temporary soil saving dams are built of stakes, brush, straw, logs, loose rock or woven wire, while permanent dams are built of earth, masonry or concrete. Most temporary dams are more or less porous, a permanent dam is water-tight so that water must flow around or over it in a spillway, or through it in a pipe with the inlet end at an elevation somewhat below the top of the dam.

SOISSONS, an old town on the Aisne River, 70 mi. northeast of Paris. It was a stronghold in Roman days and was the scene of the famous victory of the Frankish King Clovis over the Romans, in 486. Soon after it became the capital of the Neustrian kingdom from which the French monarchy sprang. Soissons is the chief center of a frequently invaded countryside and has had a stirring history. Some of the hardest fighting of the World War ravaged its surrounding hills, and it was occupied, bombarded, reoccupied, and in part burned. Pop. 1931, 18,705.

The Cathedral of Soissons, since the Revolution known also as the Cathedral of Notre Dame, was a beautiful church of the early Gothic style of the 13th century, containing also some earlier Romanesque building. It was almost completely destroyed in 1918, when the quarter about the cathedral was burned by the Germans before their final evacuation of the town. The fine south transept and much of the west front were saved, and in the years following the war the cathedral was beautifully restored.

SOISSONS, BATTLE OF, an engagement noted as the first military achievement of Clovis. It was fought in 486 against Syagrius, Count of Soissons and leader of the Gallo-Roman forces in the west, who was defeated. Clovis was then able to annex the lands of Syagrius which gave him domain over all the country between the Seine and the Loire, with headquarters at Soissons. Several important engagements were fought at Soissons during the WORLD WAR.

SOKOLOW, NAHUM (1861-), Hebrew writer, journalist and publicist, was born in 1861 at Wyszogrod, Poland. He early adopted the journalistic career, rejecting that of rabbi, for which his parents had destined him, and studied the medieval Jewish philosophical works, modern languages and Neo-Hebrew literature. In 1885 he became editor of the Hebrew periodical *Ha'ezfirah*, being the actual founder of modern Hebrew journalism. From 1889-1902 he edited the year-books *Haasif* and *Sefer Hashanah*, and in 1896 became editor of the Polish weekly *Izraelita*.

Soon after the death of THEODOR HERZL, in 1905, he became general secretary of the World Zionist Organization, where his influence gradually increased until he was elected to the presidency of the organization in 1931. The same year he was made president of the Jewish Agency for Palestine. Sokolow is a prolific essay writer for various Hebrew, Russian, English, Yiddish, French and German periodicals,

both Jewish and non-Jewish. One of his finest works is *Sinath Olam Leam Olam*, or *The Eternal Hatred For the Eternal People*, 1882. Other important works of his are *History of Zionism*, 1918, an objective historical presentation of the idea of Zionism, and *Baruch Spinoza and His Age*, 1929.

A. SH.

SOKOTRA, an island of the Indian Ocean, lying 135 mi. from Cape Guardafui. It covers an area of 1,382 sq. mi. For the most part it is an elevated tableland, with some peaks in the Haggier Mountains reaching heights of about 4,500 ft. Though the climate is dry, vegetation thrives in the valleys and tobacco, cotton, millet and dates are grown. Cattle, goats and sheep are reared in fairly large numbers. Butter is the chief export. Hadibu, or Tamarida, beautifully situated at the head of a bay on the north side, is the capital. Pop. about 12,000.

SOL, in Roman mythology, the god of the sun, identified with the Greek HELIOS.

SOL, a Peruvian silver coin and money of account, divided into ten dineros and 100 centavos, and equivalent to 28 cents, being stabilized at that value in Apr., 1931. Ten soles equal one Peruvian pound.

SOLANUM, an immense genus of flowering plants of the nightshade family. It embraces about 1,200 species found around the world in temperate and tropical climates, 25 occurring in North America, among which are many important agricultural and ornamental plants. They comprise herbs, shrubs and sometimes trees with alternate leaves and usually shallow bell-shaped, often showy, white, blue, purple or yellow flowers. The fruit is a fleshy many-seeded berry. Of the economic species the most important is the potato (*S. tuberosum*). Other valuable agricultural species are the eggplant (*S. Melongena*) and the pepino (*S. muricatum*). Among the ornamental species are the Jerusalem cherry (*S. Pseudo-Capsicum*), the scarlet eggplant (*S. integrifolium*), and the bittersweet nightshade (*S. Dulcamara*). The black nightshade (*S. nigrum*), certain forms of which produce edible berries, is a cosmopolitan weed. The horse nettle (*S. carolinense*) and the buffalo bur (*S. rostratum*), both native to the eastern United States, are spiny, often pestiferous weeds.

SOLAR DAY. See UNITS, PHYSICAL.

SOLAR ELECTRICITY, GENERATION OF, the conversion of solar energy into electrical energy by a photo-electric transformation. A silver selenide "sandwich" which has possibilities of practical use was introduced by Dr. Bruno Lange of Berlin, in April, 1931. It comprises a sheet of metal covered with a thin layer of silver selenide which in turn is coated with a transparent layer of another metal only a few molecules thick. Light passing through the transparent coating sets up an electric current between the two layers. Copper oxide was a forerunner of silver selenide in this use, but it is not practical, being estimated as requiring a \$25,000 investment per kilowatt of capacity, as compared to \$100 to \$300 for HYDRO-ELECTRIC Power generation.

SOLARIA. See *HELIO THERAPY*.

SOLAR MOTION, the motion of the sun among the stars in space, directed toward a point rather uncertainly determined in the constellations Hercules or Lyra, not far from the bright star Vega. The speed of the solar motion is found to be 13 miles per second.

SOLAR SPECTRUM. LIGHT from the sun, upon passing through a SPECTROSCOPE, is spread out into a series of component COLORS called a spectrum. This spectrum is crossed by thousands of dark lines, called *Fraunhofer lines* after the German investigator who first studied them in detail. The solar spectrum is the best example of the line type of ABSORPTION SPECTRUM. The majority of the Fraunhofer lines are produced by absorption which the white light from the main body of the sun experiences in passing through the outer gaseous layers of the sun. A few of the lines, however, are attributable to absorption by the earth's ATMOSPHERE.

When the absorption spectrum of a gas is compared with the EMISSION SPECTRUM of the same gas, it is found that many of the dark lines of the absorption spectrum correspond exactly with bright lines of the emission spectrum. Hence, it has become possible to identify the chemical elements constituting the gaseous envelope of the sun by comparison of the Fraunhofer lines with various emission line spectra terrestrially produced. HELIUM received its name from the Greek word for sun, *Helios*, because its existence on the sun was inferred from some otherwise unidentifiable Fraunhofer lines several years before it was discovered on the earth.

L. W. T.

SOLDIERS AND SAILORS MONUMENT, INDIANA STATE, a monument in Indianapolis, Ind., situated in the exact center of the city as originally laid out. It is built of Indiana oolitic limestone of a grayish color. The grounds surrounding the monument are divided into four parks and there are four approaches to the monument. Towering 285 ft. high, it is the most notable decorative feature of the city. The statue is 22 ft. in height and stands on a bronze globe 8 ft. in diameter. At the base are ornamentations in stone and bronze. Bruno Schmitz was the architect. The cost of the work exceeded \$500,000.

SOLE, the name given to a family (*Soleidae*) of flat fishes, some of which are of economic importance. They differ from other flat fishes, as the FLOUNDER, HALIBUT and TURBOT, in having exceedingly small eyes, placed close together, and a very small mouth, with the teeth minute or wanting. The tree sole (*Solea vulgaris*), the most valuable of European flat fishes, is found near shore along the coasts of southern Scandinavia and the British Isles southward to the Mediterranean. Although sometimes exceeding 2 ft. in length, it usually grows about 10 in. long, with the eyes and color on the right side. Because of the excellent flavor of its flesh it is highly prized for food. The American members of the family, as the hog choker (*Achirus fasciatus*), are of little value for food. The so-called "filet of sole" of the markets in the eastern States is usually cut from the winter flounder.

SOLEDAD, a group name given to the North American Indians who lived under the influence of the Soledad Mission, in Monterey Co., Calif. They belonged to several linguistic stocks, Costanoan, Esselenian, Salinan and Yokuts.

SOLENODON, a genus of the order *Insectivora* represented by two species, one in Cuba, and the other in Haiti. These animals, about the size of a slender half-grown cat, have a greatly prolonged snout, ratlike tails, and the nature and appearance of a gigantic shrew-mouse. The color is variable, being usually a grizzled blackish on the upper parts with a whitish spot on the nape, the sides buffy, and the under parts buffy suffused with reddish-brown. Their habits are little known.

SOLENOID, a winding generally of several superimposed layers of insulated wire in the form of a helix, which acts in general like a magnet when the wires carry a current. Solenoids provided with a plunger which does work are *tractive*; solenoids which hold only are *portative*.

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SOLENT RIVER, a strait in the English Channel between the coast of Hampshire and the Isle of Wight, terminating at the anchorage of Spithead. Its total length is 17 mi. and the width varies from 2 to 5 mi. Two bars, projecting into the Solent at Southampton and the western end, are the sites of famous Tudor castles. The Solent has an important naval position and yacht races are often held here.

SOLFERINO, BATTLE OF, an engagement fought on June 24, 1859, near the town of Solferino, Italy, between the French and Sardinians under Napoleon III and Victor Emmanuel II and the Austrians under the Emperor Francis Joseph with Generals Wimpffen and Schlick in actual command. The first encounter took place near the Mincio River when the armies met by accident. Napoleon then directed his troops to attack Solferino, strongly held by the Austrians. There was hard fighting all during the day. The Austrians finally retreated across the Mincio river, in the late afternoon when their center had been broken. Their losses were more than 20,000, while the French and Sardinians lost about 16,000. Fearful of the outcome of a second engagement, Napoleon secretly negotiated an armistice with the Austrians at Villafranca, followed, despite the protests of Cavour, Prime Minister of Sardinia, by the peace of Zürich. The victory, however, led to the formation of the Kingdom of Italy, to which the former Austrian province of Lombardy was annexed.

As a result of witnessing the horrible scenes of suffering and bloodshed during this battle, Henri Dunant described his experience in a booklet called *Un souvenir de Solferino*, published at Geneva in 1862. His proposal of an international agreement to care for the wounded led to the founding of the RED CROSS.

SOLIDIFIED CARBON DIOXIDE. See CARBON DIOXIDE SNOW.

SOLIDS, GEOMETRIC. A geometric solid is a limited portion of space bounded by parts of one or more surfaces. The **POLYHEDRON**, a very important type of solid, is one whose bounding surfaces are planes. If every section of a polyhedron which is made by a plane cutting the polyhedron is a convex polygon, the polyhedron is said to be convex. Polyhedrons are often classified according to the number of faces which they have. For example, a tetrahedron has four faces, a hexahedron has six faces, an octahedron has eight faces, a dodecahedron has 12 faces, and an icosahedron has 20 faces.

Polyhedrons are also further divided into two broad classes, called regular polyhedrons and irregular polyhedrons.

Regular Polyhedrons. A regular polyhedron is one of which all the faces are congruent regular polygons and whose polyhedral angles are equal. It is proved in geometry that there can be five and only five regular convex polyhedrons. The tetrahedron, the octahedron and the icosahedron have triangular faces, while the hexahedron has square faces and the dodecahedron has pentagonal faces as is shown in the figure. The five solids are often called

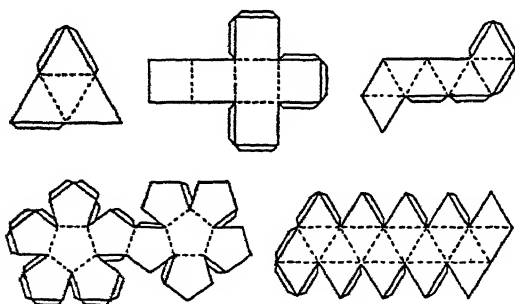
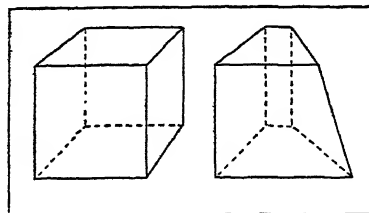


DIAGRAM SHOWING SIMPLE METHOD OF CONSTRUCTING REGULAR POLYHEDRONS

Platonic Solids. The regular polyhedrons may be constructed from paper by following the diagrams shown in the figure. If such a drawing is made on very stiff paper and gum paper is pasted on the heavy lines, the figures can be folded along the dotted lines and pasted together.

Irregular Polyhedrons. There are many types of irregular polyhedrons, that is, those that do not conform to the regular type. Two interesting types of irregular polyhedrons are the semi-regular polyhedrons and the Archimedean polyhedrons. The semi-regular polyhedrons have all of their faces, space angles, and edges equal; but their faces are not regular polygons. There are only two of this type, one of which is a common crystal form. (See **CRYSTALLOGRAPHY**.) The Archimedean polyhedrons have all their space angles equal and their faces are regular polygons, but their faces are not of the same kind. An example of the simplest one of this type will serve to illustrate. If we take a regular tetrahedron and cut off each vertex by a plane parallel to the opposite face

and passing through a point one-third the distance from the vertex to the face opposite, the resulting figure will have four triangular faces and four hexagonal faces, each face being a regular polygon. The



REGULAR AND IRREGULAR HEXAHEDRON

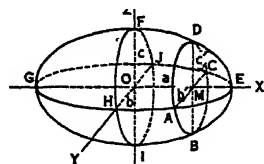
figure has 18 edges and 12 vertices, and at each vertex one triangle and two hexagons are joined. There are in all 13 Archimedean solids.

The more important simple polyhedrons, such as the prism, the pyramid, etc., are treated in elementary solid geometry.

For any polyhedron the fixed relation $E + 2 = V + F$, holds where E is the number of edges, V is the number of vertices, and F is the number of faces. This fact was discovered by Descartes, and independently by Euler (announced in 1752) and is known as Euler's Theorem. For example, in the octahedron there are 12 edges, 8 faces, and 6 vertices, as required by Euler's formula, since $12 + 2 = 8 + 6$.

One of the properties of polyhedrons is that a sphere may be inscribed in or circumscribed about any regular polyhedron. The mensuration of polyhedrons is a topic of solid geometry. The sphere, cone, cylinder and ellipsoid are other solids of importance. Of these four solids, the ellipsoid is the only one whose volume and surface cannot be found by the methods of elementary solid geometry.

The ellipsoid which is shown in the figure has three mutually perpendicular axes, usually at different lengths. If a , b and c are the semi-axes, the volume of the ellipsoid, as found by CALCULUS is $v = \frac{4}{3}\pi abc$. If $a = b = c$, the solid is a sphere of radius a , where $v = \frac{4}{3}\pi a^3$.



G. W. M.

SOLID SOUTH, a slogan used to express the unity of the southern states in supporting the Democratic party. The effect of the RECONSTRUCTION ERA was to commit southern whites to the Democratic party, and to establish the fixation that the Republican party, which had sponsored equal suffrage of whites and blacks, was inimical to white supremacy. After 1876 the voting majority in the ex-Confederate states and border states of similar interests, Missouri, Kentucky, Maryland and Delaware, was invariably Democratic. The Solid South was not breached until 1904, when

SOLID STATE—SOLITAIRE

Roosevelt (Republican) carried Missouri and one electoral vote in Maryland. In the national election of 1928 the Solid South seemed obsolescent; but the support which Hoover (Republican) then received has since returned, for the most part, to its normally Democratic affiliations.

SOLID STATE, THEORY OF. In order to offer more than a superficial explanation of the difference between solids, liquids and gases, there has developed a theory concerning the forces between the ATOMS and MOLECULES of a solid substance and concerning the vibratory motion of these elementary particles. This theory, when elaborated, leads to a satisfactory explanation of many of the properties of a solid.

According to this theory, when two atoms or molecules are moved closer to each other, the force between them undergoes radical changes. At first, when the particles are separated by ordinary distances, the force is practically zero. When they are separated by distances too small to be observed with a MICROSCOPE, the cohesive force of attraction (*see* COHESION) becomes important. An attempt to bring the particles still closer together is met by a force of repulsion which quickly becomes very large, evidenced by the difficulty of compressing a solid. This quasi-elastic force of repulsion follows Hooke's Law approximately. Deviations from this law have been used satisfactorily to explain the thermal expansion and heat conductivity of solids.

In a crystalline solid, where the atoms are arranged in a regular fashion, the theory states that the atoms are in a continuous state of vibration, approximately simple harmonic motion, about fixed points under the action of quasi-elastic forces. Estimates of the frequency of this vibration from studies of the compressibility of the solid and from its melting point indicate that it is very great. For rock salt, it may be as great as six trillion vibrations per second. When the substance is in solid form, the extent of the movement of the atoms is limited by the repulsive force, so that collision between adjacent atoms is prevented. If the body is heated sufficiently, collisions can take place, whereupon the body loses its shape, or melts. This picture of oscillating atoms, together with the QUANTUM THEORY, has led to a satisfactory formula for the variation of atomic heat with temperature. J. B. H.

SOLILOQUY, speech addressed to the void, intended to be overheard by an audience. Under older conventions it was useful for imparting information about events or emotions or for providing "cover scenes" to fill in time required for off-stage action. It persists in poetic drama and in opera, and has every right to do so; it conflicts, however, with present-day ideals of realism and truth to life, producing artificiality and "staginess," hence is valuable only in works in which such effects are not objectionable.

The "aside" is a one- or two-line soliloquy interjected into dialogue, expressing the speaker's true feelings, and, according to the ancient convention, heard only by the audience. It has little or no place in modern writing.

The most interesting use of either device in recent drama occurs in Eugene O'Neill's *Strange Interlude*, 1928, in which soliloquy and aside, devoted largely to psychological analysis, are painstakingly differentiated from ordinary speech by the expedient of bringing the stage action to a complete halt whenever the characters "think aloud." The novelty of resurrecting devices strange to the present generation of theatergoers had much to do with the play's success. The burden of the analyses could have been conveyed in a less artificial manner, while their length greatly retarded the action of the play.

It is to be noted that neither of the terms soliloquy and aside ought to be applied to the solo discourses abundant in works comprised in the increasingly important psychographic drama. When the scene, as in Elmer Rice's *Adding Machine*, is laid in the mind of a character, speech addressed to the void becomes a natural and logical mode of utterance. P. W.

SOLIN. *See* SALONA.

SOLINGEN, a German city in the Rhine province of Prussia, about 15 mi. east of Düsseldorf. In 1929 it absorbed the cities of Wald, Höhscheid, Grafrath and Ohligs. The iron industry is attributed to artisans from Damascus brought by Adolf IV of Berg, also to Styrians, who emigrated 1290. The city became Prussian in 1815 and was occupied by English troops from 1919 to 1926. Solingen is an important center of the manufacture of steel goods, particularly cutlery, forks, surgical instruments, bronze, metal and sheet metal goods, screws, saws, steel weapons, weapons, tools and umbrella frames, which are shipped to all parts of the world. Pop. 1925, 135,706.

SOLITAIRE (*Pezophaps solitarius*), a large curious bird closely allied to the Dodo, formerly found on the island of Rodriguez, where about 1775 it became extinct. It had a longer neck and longer legs than the dodo, rudimentary wings incapable of flight, and turkey-like feet and beak. The male stood nearly 3 ft. high, weighing when fat about 45 lbs., was brownish-gray in color, and possessed a knob-like excrescence on the wing, which it used as a weapon of defense; the female was smaller. The solitaire moved singly or in pairs, subsisting probably on seeds and other vegetable food and laying a single large egg on a pile of palm leaves, 1½ ft. high. Its flesh was highly esteemed for food. In North America the name solitaire is given to a thrushlike bird (*Myadestes townsendi*) of the Rocky Mountains, plain gray in color but with a very melodious song.

SOLITAIRE or **PATIENCE**, a term used for a large group of card games, played by one person with an ordinary pack of 52 cards. The group may be divided into rigid solitaire games, in which play follows the run of cards, giving the player no choice of move; and elastic solitaires, which permit the player to exercise a certain degree of judgment and selection. Most games of solitaire are based on a system of building up the suits in strict sequences, success being achieved when the spades, hearts, diamonds and clubs are made to fall into sequential piles, complete from the ace to

king. Such games, of which there are hundreds, include Canfield, Napoleon and Miss Milligan.

SOLOGUB, FEODOR (1863-1927), Russian poet and novelist, whose real name was Fedor Kuznitch Teternikov, was born in St. Petersburg in 1863, of humble parentage. The writings of this "Poe of Russia" show a peculiar mingling of realism and fancy, as is well illustrated by his *Lyrical Poems*, published 1896-1917. Sologub's best known novel is *The Little Devil*, 1907, famous for its semi-insane hero, Peredonov. *The Created Legend*, 1907-13, is an impressive quartet of novels centering around a satanic hero who has mastered the secrets of science. The author's Manichean idealism led to his association with the cult of Satanism, and his weird writings have exerted considerable influence on Russian modernism.

SOLOLÁ, a city of GUATEMALA, capital of the province of the same name, situated at an altitude of 7,100 ft., near Lake Atitlan, about 45 mi. northwest of Guatemala City. Its chief industries are the manufacture of cotton goods, soap and pottery. Cattle raising and agriculture are important. It has a reformatory school and a large prison. Most of the inhabitants are Cakchiquel Indians, whose capital was once here; German settlers cultivate coffee in the surrounding district. Sololá's houses are constructed of wood and bricks because of frequent earthquakes, which in 1902 almost destroyed the town; since it has been rebuilt. Pop. 1925, 17,334.

SOLOMON, a famous king of Israel, the second son of King David by Bath-Sheba. The sources of his history are found in the First Book of Kings: 1-12, and in the Second Book of Chronicles: 1-9. These books describe how Israel became a mighty nation under the commercial alliances and peaceful pursuits of its king, who extended his influence to all parts of the known world. Although he lost Damascus and Edom, his territory extended, according to some, from the Euphrates to Egypt. He obtained a reputation for wealth, luxury and wisdom greater than any other king of his race, and even exceeded most eastern monarchs in the luxury of his harem of 700 wives and 300 concubines. "Solomon in all his glory" became the Hebrew synonym for royal grandeur and power. The natural idealization of greatness and splendor has caused him to play a varied part in Eastern legends. The Ethiopians claim descent from him through a son which the Queen of Sheba bore him. He is credited with having written 3,000 proverbs, 1,005 songs and most of the Hebrew wisdom literature. How much is legend, how much history, or exaggeration of history, scholars dispute.

SOLOMON ISLANDS, a British archipelago in the Pacific Ocean, covering a total area of 16,975 sq. mi. The largest islands of this group are Bougainville, Malayta, Choiseul, Guadalcanar and Buka. The surface is very mountainous, dominated by volcanic cones, one of which, Bagano, is still. Coconuts, bananas, pineapples and sweet potatoes are the chief

products. Kieta, on Bougainville, is the main harbor. Pop. 1925, 25,000.

SOLOMON'S-SEAL, a genus (*Polygonatum*) of perennial herbs of the lily family. There are 30 species, natives of the north temperate zone, two of which occur in eastern North America. They are usually smooth plants with thick horizontal rootstocks, curiously marked with seal-like scars left annually by the preceding year's stems. The erect or arching unbranched stems bear large ovate sessile leaves and small greenish or pinkish drooping flowers on slender stalks from the leaf axils. The small Solomon's-seal (*P. biflorum*), which grows usually about 2 ft. high, and the great Solomon's-seal (*P. commutatum*) are common in moist woods in the eastern states and adjacent Canada, the latter extending to Utah and Arizona.

SOLOON (c. 638-558 B.C.), Athenian statesman. Elected archon in 594 B.C. he effected many economic and constitutional reforms at Athens. Among them was the abolition of the law permitting loans on the security of the debtor's person, the restriction of freedom to those enslaved for debt, and apparently a limiting of the size of individual land-holdings. Recognizing the division of the people into four classes according to the amount of their property, he for the first time admitted the Thetes, or members of the lowest class, to the Ecclesia, or sovereign assembly. Also he opened some public offices to members of the second and third classes. He also established the Athenian "boule," or senate, and the courts of justice. By reason of his statesmanship and his authorship of patriotic and didactic verse, he justly gained in antiquity a reputation for great wisdom.

SOLORZANO PEREIRA, JUAN DE (1575-c. 1654), Spanish jurisconsultant and historian. From 1609, when he was named oidor of the audiencia, to 1627 he lived in Lima, Peru. He returned in that year to Spain, where he became attorney-general for the council of treasury, and later served in the same capacity for the Council of the Indies. A writer of ability, his principal works treat the history of Spain in America, and are especially important for the study of the Spanish colonial policy. Most important among them is his *Politica indiana* (1647).

SOLOTHURN, a city of Switzerland, capital of the canton of the same name situated on both sides of the Aare River. Noteworthy are the Ursus Minster, the finest late-Renaissance edifice in Switzerland, the arsenal with a rare collection of arms, the Clock Tower, the 16th century fountains and the modern museum with old paintings. A royal residence of the New Burgundian kingdom, it became a free imperial city in 1218. Though allied with Bern, it did not become a member of the Swiss Confederation until 1481. Solothurn is the seat of the bishop of Basel and has a flourishing watch industry. Pop. 1930, 13,756.

SOLS, colloidal dispersions of substances in liquids. The name of the dispersing medium is usually prefixed, e.g., for water, *hydrosol*; for alcohol, *alcosol*; for sulphuric acid, *sulphosol*. Practically any substance

may be colloiddally dispersed in any liquid, but since colloids tend to undergo change, sometimes the life of the dispersion may be short. Chloroform dissolves small amounts of water, which, on freezing, separates as colloidal ice—a *chloroform-sol*. Most proteins (e.g., albumins, gelatine) and carbohydrate colloids (gum arabic, dextrin) form stable hydrosols, which exert protective colloidal action, i.e., they tend to prevent aggregation of particles of unstable hydrosols into larger masses. Life demands properly dispersed and protected hydrosols; such are practically all the body juices. Hydrosols of silver, mercury, and sulphur are used medicinally. J. A.

SOLSTICE, the most northerly and most southerly points of the ecliptic, which the sun reaches on the longest and the shortest day of the year respectively.

SOLUBILITY, a term employed in physical chemistry to indicate the maximum amount of any substance—gas, liquid or solid—which can be dissolved in a unit volume of a given liquid under certain conditions. The solubility of gases increases with increasing pressure and decreasing temperature; that of solids almost invariably increases with increasing temperature, often very rapidly; when the maximum amount has been dissolved, the solution is said to be saturated. (See SATURATION.)

SOLUTE, the name given to any solid substance dissolved in a liquid, the **SOLVENT**, or to a liquid which is dissolved in a larger amount of another liquid.

SOLUTIONS, mixtures of two or more chemically distinct substances which are homogeneous to such an extent that their constituents cannot be separated by mechanical means or distinguished microscopically. Usually the term is further restricted to those cases where a gas, a liquid, or a solid is dissolved in a liquid. In the first case the amount of gas dissolved, i.e., the **SOLUBILITY** increases with pressure, and decreases with a rise in temperature. Some liquids, such as water and alcohol, can form solutions in all proportions, others only within definite limits, as in the case of water and ether. Still others, as water and nicotine may be miscible in all proportions at some temperatures but not at others. Solids rarely form solutions in all proportions, and a liquid can contain only up to a definite amount of the solid, at which point it is said to be saturated (see SATURATION). Almost invariably the solubility of a solid increases with the temperature, and often the process of dissolving the solid in the liquid causes a lowering of the temperature. The presence of the dissolved substance in the liquid reduces the vapor pressure of the latter, raises the boiling point and lowers the freezing point. It has been shown that, in the case of dilute solutions of simple substances which are not electrolytes and are thus not subject to electrolytic dissociation, the changes brought about in these physical constants of the solvent are proportional to the molecular concentration; that is, to the ratio between the number of molecules of the solute and that of the solvent. The mere presence of the molecules of the

dissolved substance in the liquid causes a pressure, called the osmotic pressure (see OSMOSIS AND OSMOTIC PRESSURE), entirely analogous to the pressure exerted by the molecules of a gas, and subject to the same laws. With electrolytes, however, the problem becomes much more complicated; for discussion of its principal points see IONIC THEORY. W. J. L.

SOLUTREAN CULTURE, the second stage of culture of the Upper PALAEO-LITHIC PERIOD, following the AURIGNACIAN. It is represented by discoveries at Solutré, in the department of Saône-et-Loire, central France. The Solutrean stage is distinguished by the beauty of its flint implements, especially the javelin heads, "by far the finest specimens of flint-flaking which the whole Palaeolithic Period has to show" (MacAlister). They are marked by a delicate chipping over the whole surface. Solutrean bone implements are inferior to Aurignacian. Elaborate ornaments were made of pierced shells strung together. The Solutreans are thought to represent a new invasion from the East, which drove the Aurignacians before them. Solutrean art shows some recession from the Aurignacian stage. A series of high reliefs on stone has recently been found at the station of Le Roc (Charente). It is probable that paintings on the walls of caves, so well developed in the Aurignacian stage, were continued in the Solutrean stage, but it is difficult to distinguish them from the earlier and later paintings. See ARCHAEOLOGY.

SOLVAY, ERNEST (1838-1922), Belgian industrialist, was born at Rabecq near Brussels Apr. 16, 1838. In 1863 he invented the ammonia process of soda manufacture and established plants throughout the world. By 1880 his plants produced over half, by 1913 nearly all, of the world's soda consumption. Solvay became a leading philanthropist, aiding French and Belgian charitable and educational institutions and founding the Solvay Institute at Brussels for sociological work. He died at Brussels, May 25, 1922.

SOLVAY, a village in Onondaga Co., central New York, situated on Lake Onondaga, just west of Syracuse; it is served by bus lines and the Auburn branch of the New York Central Railroad. There are large soda ash deposits in the vicinity. The village has a soda ash plant, pottery, chemical and electrical factories. Solvay is a residential as well as an industrial suburb. It was founded in 1884 and incorporated in 1894. Pop. 1920, 7,352; 1930, 7,986.

SOLVENT, the name given to the liquid in which a solid, or a gas is dissolved, or, in the case of a homogeneous mixture of two liquids, to that one of the liquids which is present in the larger amount.

SOLVENTS, INDUSTRIAL. Modern industrial development is to no small extent dependent upon the success of chemistry in furnishing a large and cheap supply of industrial solvents. Research and competition have made these products available from widely different and apparently inexhaustible sources.

Production. From the fractional distillation of petroleum are secured solvents of the gasoline type, benzene, naphtha, etc. In the distillation of tar from

by-product coke ovens, thus indirectly from coal, benzol, toluol, and their homologues are obtained; and from the direct action of sulphur upon the coke, carbon bisulphide is produced. Wood, by destructive distillation yields methyl alcohol, acetone, acetic acid, etc., and the growing pine tree furnishes turpentine. The fermentation industry produces from molasses, corn or potatoes not only ethyl alcohol, but butyl alcohol, acetone, and acetic acid in quantity. Possibly the greatest developments in recent years have been the synthesis of a great variety of solvents, both old and new, from gases. Methanol is now made from fermentation gases, water gases and waste furnace gases; acetylene leads to acetic acid and acetaldehyde; while from other hydrocarbon gases are secured ethanol, ether, glycol, isopropanol, acetone, amyl alcohol, butanol, ethylene chloride and many derivatives.

The following table lists the production figures of a few of the major industrial solvents in the United States during 1929:

Acetic acid	85,780,056 lbs.
Acetone	40,000,000 lbs. (est.)
Benzol	25,119,013 gals. (exc. motor benzol)
Butyl acetate	38,780,056 lbs.
Butyl alcohol	67,500,000 lbs.
Carbon bisulphide	71,009,798 lbs.
Carbon tetrachloride	34,719,934 lbs.
Ether	6,936,047 lbs.
Ethyl acetate	73,895,640 lbs.
Ethyl alcohol	106,960,000 gals.
Formaldehyde	51,786,422 lbs.
Methyl alcohol	10,000,000 gals. (est.)
Toluol	17,064,206 gals.
Turpentine	35,837,443 gals.

Uses. The industry which has greatly contributed to the remarkable growth in variety and production of industrial solvents is the lacquer industry. Estimates show that in the United States in 1929, the lacquer industry consumed approximately 270 million pounds of solvents comprising naphtha, toluol, ethyl and butyl alcohols, ethyl and butyl acetates and many other newly developed chemicals. The closely related groups of paint, varnish, enamel and stain manufactures require equally large quantities of the more familiar solvents, especially naphtha, turpentine and benzol. The newer fabrics particularly artificial leather and silk require methanol, acetone and benzol while the older textile, leather and dyeing industries use increasing volumes of industrial solvents. Carbon bisulphide is extensively consumed in rubber manufacturing, and carbon tetrachloride is the familiar constituent of fire extinguishers and dry-cleaning fluids. A large variety of solvents is used in such other industries as cosmetics, pharmaceuticals, inks, polishes, photographic film, acetylene and oil extraction.

A. L. W.

SOLVENT SCOURING. See SCOURING.

SOLWAY FIRTH, an inlet of the Irish Sea, extending between England and Scotland. It is about 50 mi. long and has breadth of 32 mi. At its head it receives the water of the Esk River from England,

and from Scotland the rivers Dee and Annan empty into it.

SOMALILAND, a coastal region of Africa forming the farthest eastern peninsula of the continent. The country is divided into FRENCH SOMALILAND, ITALIAN SOMALILAND and Somaliland Protectorate.

Somaliland Protectorate. The protectorate is a British territory on the African coast of the Gulf of Aden, extending inland to Abyssinia on the west and south and Italian Somaliland on the east. The area covers about 68,000 sq. mi. The population, estimated at 344,700, includes 2,000 Arabs and Indians in the coast towns. The remainder are Somalis, a race of mingled Negro and Hamitic blood, mostly Mohammedans. Europeans are few, and act only as administrators and missionaries.

The coast land is hot, arid and sandy, and receives only a small and uncertain amount of rainfall in winter. Inland, there is an abrupt rise to a height of from 4,000 to 7,000 ft. On the southern slopes occurs the densest vegetation, savanna in character and including forests of juniper and box. Although cattle are scarce the blackhead sheep of the territory are renowned for their fine-grained skin, regarded as the best in the world for the manufacture of high-grade gloves. Agriculture and transport are in a low stage of development, but millet is grown to some extent in the west and a few stretches of motorable roads exist.

The protectorate is one of the richest game sections in Africa. Deer are numerous, and a few miles inland elephants, lions, leopards, wolves and hyenas are found. Berbera is the capital and chief town.

SOMATOLOGY, a branch of PHYSICAL ANTHROPOLOGY. It is concerned most particularly with individual, sexual and racial variations of the living human body. The ordering of the variations of the body into types and races; their relations to each other, to environment and to evolution; their structural characteristics are all subjects for somatological study. For more complete reference see ANTHROPOMETRY; RACES OF MANKIND.

SOMBOR or **ZOMBOR**, a city of the former Vojvodina, YUGOSLAVIA, located about 120 mi. south of Budapest on the Francis Canal. Surrounded by rich, level land, it is the focus of the neighboring district's commerce in corn and cattle. Matches and flour are made in Sombor. Before the World War, Sombor was a royal free town of Hungary. In 1918, upon the disruption of the Austro-Hungarian Empire, it was incorporated in the Yugoslav Kingdom. Pop. 1931, 32,256.

SOMEHULITK, a North American Indian tribe, a sub-group of the Heiltsuk, belonging to the Kwakiutl group of the Wakashan linguistic stock, and now living on Wikeno Lake, Brit. Col.

SOMERSET, a city in southeastern Kentucky, the county seat of Pulaski Co., situated 79 mi. south of Lexington. It is served by the Southern Railroad. The region has coal mines and large tracts of hardwood timber. It is splendid agricultural and stock-raising country. The crops include tobacco, grain and

fruit. Somerset manufactures golf clubs, milk products, canned foods, railroad ties, and has a refinery and railroad shops. Pop. 1920, 4,672; 1930, 5,506.

SOMERSET, a town of southeastern Massachusetts, in Bristol Co., situated on the Taunton River, 45 mi. south of Boston. It is on the New York, New Haven and Hartford railroad. Stoves and iron products are the leading manufactures. Pop. 1920, 3,520; 1930, 5,398.

SOMERSET HOUSE, a large quadrangular building, between the Strand and the Victoria Embankment, London, built by Sir William Chambers in 1776-86, on the site of the palace of the Protector Somerset, begun in 1549. The main façade facing the Thames is 600 ft. long. Occupied by the Admiralty, and later by the Royal Society and the Royal Academy, it now houses King's College in the east wing and, in the rest of the building, the offices of the Board of Inland Revenue, the Registrar-General of Births, Marriages, and Deaths, and the Principal Probate Registry. Perhaps of greatest interest at Somerset House are the paintings by Cipriano and the wills of famous people (dating from 1382).

SOMERSWORTH, a city in southeastern New Hampshire, in Strafford Co., situated on the Salmon Falls River, opposite Berwick, Me., and served by the Boston and Maine Railroad. The city has cotton and woolen mills operated by water power, and a shoe shop powered by electricity. Somersworth was incorporated as a parish in 1729 and as a city in 1893. Pop. 1920, 6,688; 1930, 5,680.

SOMERVILLE, WILLIAM (1675-1742), English poet, was born at Colwich, Staffordshire, Sept. 2, 1675. He settled at Edstone as a country gentleman, dividing his time between field sports and literature. His principal work is *The Chase*, 1735, a poem in blank verse. Among his other works are some fables in verse, a burlesque entitled *Hobbinol*, and *Field Sports*. Somerville died at Edstone, July 18, 1742.

SOMERVILLE, a city in Middlesex Co., eastern Massachusetts. It is a suburb of Boston, located on the Mystic River and is served by three railroads and by bus lines. The principal industries are slaughtering and meat-packing and tube and automobile manufacturing. In 1929 the factory output was valued at about \$113,000,000; the wholesale trade proper amounted to \$6,985,417, and retail trade to \$29,631,912. The city was founded by Governor John Winthrop in 1630 as a part of the Massachusetts Bay Colony and includes most of his Ten Hills Farm. The old powder magazine originally built as a windmill stands in Nathan Tufts Park. The first display of the flag of the 13 colonies, the Union Jack and stripes, took place here in 1776. In 1842 the town of Somerville was set off from Charleston. Somerville became a city in 1872. Pop. 1920, 93,091; 1930, 103,908.

SOMERVILLE, a borough and the county seat of Somerset Co., N.J., located on the Central Railroad of New Jersey, 35 mi. west of New York City. It is the trading center for a prosperous rural district

notable for the production of dairy products, corn, wheat and oats. Nearby are located a number of large country estates. Somerville has many points of historic interest including a house used as a headquarters by Washington from Nov. 1778 to June 1779. It was incorporated as a borough in 1909. Pop. 1920, 6,718; 1930, 8,255.

SOMME, BATTLE OF THE, a major British and French offensive, during the WORLD WAR, which consisted of a series of engagements between July 1 and Nov. 13, 1916, launched on the 23-mile front Bapaume-Peronne, facing the junction of the Franco-British lines in northern France. Following the example set by the Germans at Verdun, the British, with slender French support, bombarded the German front and rear defenses continuously for one week, and on July 1 moved forward. The British launched 15 divisions on a 15-mile front, north of the Somme, and the French contributed five divisions for their advance along an 8-mile front, south of the river. The attacking infantry advanced in steady waves. German machine-gunners crawled out of their subterranean shelters, which the British believed were demolished, and mowed down the advancing targets. The British losses were the greatest of any single day in the World War.

Although checked before Bapaume on the left, the British made an appreciable advance on the south, near Fricourt. On July 11 they captured Trones Wood, and four days later occupied Pozières. Meanwhile the French advance on the far right had pushed to within two miles of Peronne. Early in August the British gained the top of a crest near Courcellette, from which they could see Bapaume, six miles distant. On Sept. 12 the French and British captured command of the Peronne-Bapaume road, and three days later the first British tanks aided in capturing Flers. But the Allied impetus was spent, and the last drive in the Somme offensive ended Nov. 13, when the British captured Beaucourt, another point overlooking Bapaume. The British mistakenly continued the advance down the slopes, and in consequence spent the winter in water and mud. While the Allies had advanced their front and captured an estimated 16,000 prisoners, the imminent German retirement to the "Hindenburg Line" and the enormous Franco-British casualties lessened the fruits of the Somme offensive.

SOMNAMBULA, LA, an opera by VINCENTO BELLINI, libretto by Felice Romani; première, Milan, March 6, 1831; first performed in the United States Nov. 13, 1835, at New York.

The action takes place about 1800 in a Swiss village. Amina, in love with Elvino, loses him when she is seen at night entering the room of a handsome guest at the village inn. Elvino is ultimately persuaded, a few moments before his proposed marriage to another village girl, that Amina is a sleep-walker, and reconciliation ensues. The rôle of Amina was made famous by JENNY LIND.

SOMNAMBULISM, literally, sleep-walking, but generally used to designate actions of an intelligent

nature performed in a sleep-like or trance state. Such conditions occur in ordinary sleep when the sleeper arises and walks, upon a special quest, yet oblivious to his surroundings generally. He may be led back to bed; if awakened, he will be dazed for a moment before resuming consciousness. The somnambulist may awaken without knowledge of his nocturnal excursion, but may recall in the next attack what was done in the previous one.

The parallel between this condition and the hypnotic state (*see* HYPNOTISM) is so close that somnambulism may be called spontaneous or natural hypnosis. Similarly when first noted by the Marquis de Puységur, the hypnotic state was called artificial somnambulism. The sleep-walking of Lady Macbeth is a correct though dramatic depiction of the condition. Its natural occurrence is an indication of a marked hysterical tendency, and is most common in young girls. *See* HYSTERIA.

SOMNILOQUISM. *See* INSOMNIA.

SOMNUS, in Roman mythology, the Roman equivalent of the Greek Hypnos, god of sleep, was son of EREBUS and NOX and brother of MORPHEUS, god of dreams, was in attendance on him. Somnus dwelt in the far west from which he sent sleep to mortals. He is represented in various ways, but usually with a horn from which he pours sleep.

SONATA, the generic name of an instrumental composition, being any piece to be sounded (from *sonare*, to sound, to play), but to be distinguished from the CANTATA, the early name of any vocal composition. In the 16th century the term was used for compositions calling for several instruments, and not until the time of C. P. E. Bach (1714-88) was it given its definite and present meaning, namely, a composition in several movements for a solo instrument. Indeed, although Arcangelo Corelli (1653-1713) and DOMENICO SCARLATTI (1684-1757) had previously contributed to the work of forming the sonata as it is known to-day, the final touches were put on by FRANZ HAYDN (1732-1809) and WOLFGANG MOZART (1756-91). It is for this reason that "Haydn form" and "sonata form" are considered identical titles, irrespective of the fact that Mozart did much to polish that form and Beethoven to invest it with profundity.

Although inevitably a sonata will vary in structural detail, according to the mood of its composer, its general outline is constant, taking the form in most cases of 1. an allegro, 2. an adagio, 3. a SCHERZO or minuet, and 4. a finale, which is often a RONDO. These separate movements, contrasted in tempo, are contrasted also in tonality, although the key arrangement is subject to so many variations that no specific rules can be laid down, save that the first and last movements have the same tonality, pursuant to the nearly universal practice of ending every composition in the key established at its beginning.

Genetically, the sonata is related to the SUITE which is a collection of contrasted dance movements, but it has departed conspicuously from its origin in one important particular, namely, the formal and elaborate

construction of the first movement. To this particular pattern on which the first movement of a sonata is based is given the technical name, sonata-form. An entire sonata, in one sense, is in sonata form; but it is important to remember that the term sonata-form technically applies only to the first movement, since it is there that the individuality of a sonata lies in essence.

Broadly speaking, this first movement of a sonata is a development of two themes in contrasted keys. Examined in more detail it breaks down into three separate sections: 1. Exposition, 2. Development, 3. Recapitulation, each of which requires separate comment.

1. **Exposition.** Here the subject matter of the sonata, or thematic material, is announced. The first subject is presented in the tonic, and is followed, usually in the dominant, by the second subject. Some subsidiary matter may be incidentally interjected, but the announcement of the two themes is of chief importance.

2. **Development.** Here the material offered in the expository first section is developed; that is to say, the composer is now at liberty to amplify his original statements, to ring as many changes on them as he deems desirable. He may modulate to remote keys and, in short, may move freely in the realm of fantasy as long as he continues to extract variety from his initial statements. One of the great contributions of Beethoven lay in this field; it was his genius for developing thematic material which in itself was often unremarkable that placed him head and shoulders above his contemporaries.

3. **Recapitulation.** This concluding section serves to round out the first movement. After the two themes have been subjected to varied treatment, a return to them in their natural state proves desirable. Both are therefore announced again, and in the home key. Thereafter the movement is brought to a close with a short concluding section called a CODA.

SONDERBUND. The Swiss Confederation, as reestablished by the Congress of Vienna in 1815, was a loosely united group of cantons, each with almost complete local autonomy, and each sending delegates to a central diet whose function it was to deal with matters of general interest to the entire confederacy. Although the arrangement was workable, the decades following 1815 witnessed the gradual appearance in intercantonal relations of sectional feelings and attitudes. This was due largely to the existence of economic and religious differences between the various local units. A number of the cantons were interested chiefly in agriculture and dairying, were of the Roman Catholic faith, and were more or less under clerical control. The remaining cantons, most of which were in the north, were most interested in industry, contained several large and important cities, were inhabited chiefly by Protestants, and were not politically subservient to the clergy. In these northern cantons, too, the contemporaneous European movement for democracy and liberalism had gained

considerable ground. In 1847, accordingly, the seven Catholic cantons organized a *Sonderbund*, or "separate league," in order to safeguard their particular interests and those of the Church.

The federal diet ordered the seceding association to dissolve, and when the demand went unheeded, the northern cantons overwhelmed the league by force. Metternich in Austria, and other reactionary foreign diplomats, indicated a willingness to intervene on behalf of the conservative *Sonderbund*, but the numerous revolutions that broke out in 1848 kept these men so occupied at home, that the cause of liberalism was able to triumph in Switzerland. After their victory over the *Sonderbund* the liberals drew up a new constitution for all the cantons in 1848, converting the loose confederacy into a somewhat more centralized federal republic. Each canton, however, continued to enjoy wide powers of local autonomy.

W. C. L.

See W. D. McCrackan, *Rise of the Swiss Republic*, 1901.

SONG, a vocal composition, for solo voice, usually with instrumental accompaniment. It is distinguished from an *ARIA* in that it does not form part of an extended work such as an *ORATORIO* or an *OPERA*. The German *Lied*, the French *chanson*, and the Italian *canto* or *canzone* are synonymous.

It is generally supposed that vocal music was the earliest form to be developed by man's primitive forbears. The most direct and natural type of tonal utterance, it arose early in the world's history. Prior to the rise of instrumental music in the 17th century, singing was practised almost exclusively, taking the form of the plain chant or *GREGORIAN CHANT* of the early Christian Church, and being developed on its secular side by the *MINNESINGER* of the medieval period.

Two general types of song may be distinguished: the folk-song, or *Volkslied*, a more or less spontaneous musical expression of a people which is often without known origin; and the art-song, or *Kunstlied*, a more sophisticated composition in which the accompaniment is an integral part of the creation, rather than the mere support of a simple, direct melody. It was out of the marriage of instrumental and vocal music that the art song was born in the 18th and 19th centuries, being brought to its full maturity by such masters as *FRANZ SCHUBERT*, *ROBERT SCHUMANN*, *ROBERT FRANZ*, *HUGO WOLF* and *JOHANNES BRAHMS*.

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SONGISH, a North American Indian tribe speaking a language of the Salishan linguistic stock whose name for themselves is *Lkungen*. Songish is also the name of a Salish dialect which is spoken by the *Sanetch* and *Sooke* of Vancouver Island, by the *Clallam* of Juan de Fuca Straits, and by several of the coast tribes south of the Fraser River delta. The Songish, now numerically negligible, live around Victoria on Vancouver Island, Brit. Col., and on the west shore of San Juan Island.

SONG OF SOLOMON, THE, in the Old Testament, also known as *The Song of Songs* and *The Canticle of Canticles*, has, from the days of the formation of the Jewish canon been regarded as a spiritual song using the symbols of love and marriage to illustrate the relationship between God and Israel. In the Christian view it was held likewise to illustrate the relation between God and the human soul. The tendency of many modern scholars is to conceive of the book as an anthology of songs used at marriage festivals in or near Jerusalem, edited and loosely arranged, not by Solomon, to whom the earlier age ascribed it, but by a post-exilic writer. Its value still rests, however, in its pure conception of true love and its joy in nature, opening a window into the heart of the Hebrew race, for a vision not easily obtainable through their other literary remains.

SONNET, a 14-line poem with a prescribed rhyme scheme, originated in Italy during the 13th century as a lyric to be set to music. It is usually in iambic pentameter, although sometimes found in iambic tetrameter. The Petrarchan sonnet, the most widely followed form, consists of two divisions: a first section of 8 lines, called the octave and made up of two quatrains; and a second section of six lines made up of two tercets, called the *SESTET*. The sonnet is an expression of a single thought, but there is generally a break in sense, which may be merely a different way of approaching the subject, between the octave and the sestet. The rhyme scheme of the Petrarchan sonnet is *abba abba cde cde*, though *cdc*, *dcd* and other arrangements occur in the sestet. Wyatt and Surrey in the 15th century introduced the sonnet to England, where *SPENSER* and *SHAKESPEARE* varied the form by making it three quatrains followed by a couplet which summed up the thought expressed. They also varied the rhyme scheme to *abab cdcd efef gg* and *abba cddc efef gg*. Among the most famous English sonneteers, after Spenser and Shakespeare, are Sidney, Milton, Wordsworth, Coleridge, Keats, Mrs. Browning and the two Rossettis, Dante Gabriel and Christina. The modern French poets use the form *abba abba cc de de*.

SONNINO, SIDNEY CONSTANTINO, BARON (1847-1922), Italian statesman, financier, and sociologist, was born at Pisa, Mar. 11, 1847. He studied law at the University of Pisa, and later served in the Italian diplomatic corps. In 1877 he published *The Peasants of Sicily*, which gave impetus to agricultural and industrial reforms in the country. He was elected to Parliament in 1880, and in 1896 became Finance Minister. In 1906 and 1909 he was Prime Minister for short periods. Sonnino became Minister for Foreign Affairs in 1914, and in this office supported Prime Minister SALANDRA in the latter's efforts to win over Italy to the side of the Allies. Later he was a member of the Italian delegation to the Versailles Peace Conference. Sonnino died at Rome, Nov. 24, 1922.

SONORA, a state of Mexico, in the northwestern part of the republic, lying parallel to Lower California,

with the Gulf of California between. It has an area of 76,633 sq. mi., and is traversed by the Sierra Madre Occidental Mountains along its eastern border. The climate is hot and dry along the coast and arid in the northern part of the state. The valleys are productive under irrigation. Among the important rivers are the Yaqui, Asuncion, Sonora and Mayo. Sonora is one of the richest mining states in Mexico, and there are about 150 mines within its borders. It is especially famous for an unusual gray marble that gives forth a tinkling sound when struck. Some of the most fertile parts of the state are occupied by hostile Yaqui Indians, who have been a menace to the inhabitants for many years. The capital is Hermosilla, and other towns are Guaymas, a port, Nogales, and Cananea. Pop. 1921, 275,127; 1930, 315,312.

SONORA, an old historical town in central California, the county seat of Tuolumne Co. It is situated 60 mi. east of Stockton and is served by the Sierra Railway of California. Gold mining and lumbering are the chief industries. Mark Twain (**SAMUEL CLEMENS**) and **BRET HARTE** both lived and wrote in Sonora. Pop. 1920, 1,684; 1930, 2,278.

SONS OF LIBERTY. (1) Secret associations, interrelated mainly by correspondence, organized in 1765 by Patriots in the THIRTEEN COLONIES in opposition to the STAMP ACT, and continued as a political expression of the Revolutionary cause. They initiated much of the resistance against British measures of taxation, were active in supporting the NONIMPORTATION AGREEMENT, and at times staged popular demonstrations. (2) A secret, treasonable society, 1864-65, in the northern states, particularly in Kentucky, Ohio, Indiana, Illinois and Missouri. This society, a recrudescence of the KNIGHTS OF THE GOLDEN CIRCLE, embodied a double organization: an outer one in which the purpose was ostensibly to ensure the success of the Democratic party at the polls, and an inner organization, military in character, whose purpose was to give aid and comfort to the Confederacy. **CLEMENT L. VALLANDIGHAM** was its supreme commander. The society resisted the draft by armed rioting, and protected deserters and escaped prisoners of the Federal army. Its project for a general armed uprising in the Mississippi Valley, which should establish a North-western Confederacy, was checked by the arrest of its leaders.

SONS OF THE AMERICAN REVOLUTION, National Society of the, a patriotic society founded in New York City in 1889 and incorporated by Act of Congress in 1906. It was organized by members of the Sons of Revolutionary Sires and the Society of the Sons of the Revolution, with the object of perpetuating the memory and spirit of the men who achieved American independence, and to further research in relation to the Revolution, also to preserve historical documents and records of this period. Membership is limited to direct descendants of an ancestor who actually served in the cause of independence in some accredited capacity. There are several state branches and the total membership is about 21,000.

SONS OF VETERANS, a patriotic society organized at Philadelphia, Pa., Sept. 29, 1879, from cadet corps attached to posts of the GRAND ARMY OF THE REPUBLIC. All male descendants 18 years or more of age of deceased or honorably discharged Union soldiers, sailors and marines are eligible to membership. Its purpose is to inculcate patriotism and to aid and assist members of the Grand Army of the Republic.

SONSONATE, a city of Salvador, situated about 50 mi. from San Salvador, and 12 mi. from Acajutla, near the volcano of Izalco. It is the center of a rich agricultural district, which produces sugar, coffee, corn, fruit and hides, and is the only place where Peruvian balsam is found. The industries are the manufacture of coarse cotton cloth, baskets and cigars. Pop. 1930, 20,343 with suburbs.

SOOCHOW, a rich Chinese silk center 60 mi. from Shanghai in the province of Kiangsu. It is built on the banks of the Grand Canal and a complicated set of waterways gives it the description of Venice in China. A Chinese proverb judges it one of the two most beautiful places in the country, saying: "Above is Heaven—below Soochow and Hangchow." Lakes and hills to the east and west, and pagodas, temples and famous gardens within the city's walls, have made Soochow the residence of officials and one of the recurring names of Chinese literature. Its streets are tortuous, cobble-stoned paths winding before the front walls of homes or beside the canals.

As an aesthetic and cultural leader no city in China except Peiping holds a higher reputation. Rock gardens with flowers that bloom three and a half seasons a year, paintings for sale at the markets or guarded in private collections and luxurious traveling on the varnished house boats remain in Soochow to carry on its reputation for beauty and wealth. Seven pagodas, one of them the tallest in China, raise their flaring corners above the sloping black tile roofs of the houses. The center of worship in the province is at the City Temple, first built in 300.

Silks, satins, gauze and cotton are woven in modern or ancient designs. The city lies in the fertile fields of Kiangsu and has a large trade in rice circulated through waterways connecting it with the north, south, east, and northwest. Soochow was opened to foreign trade after the Sino-Japanese War in 1896 and was made one of the stations of the Shanghai-Nanking Railroad in 1909. Its walls have stood more than 2,400 years. The Chinese philosopher Confucius made the city his literary center. It was the capital of the ancient kingdom of Wu until 473. The Tai Ping rebels captured it in 1861 with terrible slaughter and freedom was not restored until 1863. The most beautiful women and some of the most brilliant scholars of China are said to have come from Soochow. Its speech is noted for softness. Pop. 1929, 260,000.

SOOKE, a North American Indian tribe, speaking the Songish dialect of the Salishan linguistic stock. They lived in the vicinity of Sooke Inlet on Vancouver Island in British Columbia and are now extinct.

SOONG, T. V. (1891-), Chinese finance leader, was born in Shanghai. After graduating from Harvard (1915, A.B. in Economics), he worked for a time with banking firms in New York, and then returned to China, where he allied himself with the Nationalist organization, as Minister of Finance of the Nationalist Government at Canton. He organized the finances of the area with notable success. He continued as Minister of Finance when the Nationalist Government established itself at Nanking in 1928, and held the post until the Chiang government fell in Dec., 1931. Soong has been strikingly successful in his efforts to secure the cooperation of the Chinese bankers in the financial activities of the government. He has been one of the two or three most powerful leaders in government circles, largely because he won the confidence and respect of the Chinese banking community.

SOOT BLOWERS, mechanically operated apparatus for cleaning the soot from the outside of the tubes in BOILERS and ECONOMIZERS. They consist of a long pipe or element fitted with a series of nozzles, the element being rotated by a hand chain through a pulley and a set of gears. A valve automatically admits steam or compressed air to the nozzle. This valve is held open during one revolution of the element and then closed.

SOPER, EDMUND DAVISON (1876-), American educator, was born in Tokyo, Japan, July 16, 1876. He was graduated from Dickinson College, 1898 and 1913, and from Drew Theological Seminary, 1905. After holding professorships of religion at Ohio Wesleyan University, Drew Seminary and Northwestern University, 1910-25, he became vice-president and dean of the School of Religion at Duke University. In 1928 he was elected president of Ohio Wesleyan University.

SOPHISTS, Greek teachers of philosophy, 5th century B.C. SOCRATES is sometimes classed with them but his motives were much more sincere than were those of some of the Sophists. These teachers were willing to argue anything and were peddlers of questionable wisdom. Their methods are well brought out in Plato's *Dialogues*, and it is from this source that our information about them is largely derived. Because of the lack of honesty in many of their arguments, the term sophistry has come to stand for specious reasoning. The Sophists were masters of the art of persuasion, but their reasoning was often faulty. The best known among them are Protagoras, the relativist, and Gorgias, the nihilist.

SOPHOCLES (about 496-406 B.C.), second of the three great writers of tragedies who made Athens famous as the home of the Drama. Sophocles reached manhood immediately after the decade of Persian attacks on Greece, whose triumphant resistance led to the Great Age of Greek art. The future dramatist was born in a country district just outside Athens, Colonus, which he describes in one of his plays as a region watered by the silvery Cephissus, and rich in flowers and trees among whose leaves the night-

ingales sang. The young Sophocles was famed for beauty and grace, and was chosen to lead the solemn dance to celebrate the crowning victory of Salamis over the Persians. He was trained as a singer, so that his development as an actor and a writer of plays was natural. When he was 28, in 468 B.C., he defeated Aeschylus in the great competition of tragedies in the theater at Athens, and, continuing to write until his death at 90, he won the victory for his tragedies about 20 times. While Aeschylus in his dramas of simpler form had sought to depict the majesty of divine order and unswerving fate, Sophocles, adding a third actor and developing more dramatic situations, sought to show the sovereign moral law as illustrated in noble human conduct. Of his 90 plays, only seven remain, with fragments of some others. *Antigone*, which won the first prize, is a study of a noble-spirited girl who accepts death for a moral principle. Her loyal, courageous if somewhat rigid character is brought out by contrast with her more pliant sister, Ismene. *Electra* is also a study of a woman's heroism, with a like contrast between two sisters, Electra and Chrysothemis. The *Trachinian Maidens* (so-called from the chorus) is a study of Deianira, wife of Hercules, who unwittingly brings her heroic husband to destruction. The two tragedies of Oedipus (*Oedipus the King* and *Oedipus at Colonus*) depict an essentially noble man contending against an awful destiny. *Ajax* is the tragedy of one of the Homeric heroes, afflicted with madness because he incurred the enmity of the gods. *Philoctetes*, probably his last play, written in 409 B.C., also belongs to the story of Homer. The play is a study of character, of heroic determination and final obedience to the command of destiny. It has been well said that Sophocles was the teacher of EURIPIDES, but not the pupil of Aeschylus. He died in 406 B.C.

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SOPHRON OF SYRACUSE (5th century B.C.), Greek writer, lived about 430 B.C. He is noted for his mimes, chiefly comic scenes of ordinary Sicilian life and ranked as first mimes of literary value. Sophron wrote in the Doric dialect and employed both male and female characters in his dialogues.

SOPORIFICS, a group of medicinal substances used to cause or induce sleep. Soporifics or narcotics have much the same general action as anesthetics (see ANESTHESIA), but are used only to produce the first stages of imperfect consciousness or sleep. Anesthetics might be used were it not for the comparatively short time in which their action persists. In general, the NARCOTICS are less volatile than general anesthetics. Soporifics may be divided mainly into three classes: (1) the chloral hydrate group, (2) the sulphone group, and (3) the ureide group. In addition, there are a few miscellaneous soporifics. The *chloral group* is represented chiefly by CHLORAL HYDRATE. The second group, or *Sulphonmethane group*, is composed of the triad sulphonmethane (sulphonol), sulphonethylmethane (trional), and sulphonethyl-

methane (tetronal). The *ureide* group is composed of such substances as carbomal, urethane, and particularly barbital and its derivatives. The most widely used of all of the hypnotics to-day are BARBITAL and preparations resembling barbital in both action and chemical structure. The commercial names of these preparations are Phenobarbital, Luminal, Amytal, Dial, Ipral, Neonol, Nostal, Pernoston, Phanodorn, etc. In certain localities, the sale of the barbital compounds is restricted, due to habit-forming attributes.

P. N. L.

SOPRANO, the highest female voice, having the normal compass *c'* to *a''* but in exceptional cases descending to *a* and up to *c'''* or even *e'''*. Probably the highest soprano voice in music history was that of Lucrezia Agujari, a contemporary of MOZART, who touched *c'''* (three octaves above middle C). Nowadays the soprano part is written in the G, or treble, clef; but in former times the soprano clef was used for it, being the C CLEF placed on the first line of the staff.

SOPWITH, THOMAS MURDOCH (1888-), British aviator and airplane manufacturer, was born in 1888. He received a technical education at Seafield Engineering College. Sopwith gained prominence in 1910 by a flight from England across the English Channel, and two years later raised the capital with which to organize the Sopwith Aviation Co., Ltd. In 1914-18 he designed and built military and naval planes for the British government, also serving in this period as co-director of the H. G. Hawker Engineering Co., Ltd. He was named a C.B.E. in 1918 and in 1925-27 served as chairman of the Society of British Aircraft Constructors.

SORABIAN or **WENDISH**, a West SLAVIC language spoken by some 30,000 people in the Lausitz, belonging partly to Saxony and partly to Prussia. A transitional form between Czech (see CZECHO-SLOVAK) and POLISH, it is divided into two dialects: High Sorabian in the Oberlausitz, and Low in the Niederlausitz, High Sorabian standing nearer to Czech, and Low to Polish. The earliest Low Sorabian literary document is a manuscript translation of the New Testament, 1548, while the first High Sorabian publication was a catechism, 1597. A. SE.

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SORANUS, (98-138 A.D.), Greek physician and a follower of the methodist school of medical practice, was the ancient leader in obstetrics, gynecology and pediatrics, there being no real improvements in obstetrics up to the time of PARÉ, about 1500 years later. The book by Soranus on *Midwifery and Diseases of Women* constituted a real contribution and was the original of several subsequent volumes in later centuries, wherein the introduction of supposedly new devices and new methods have been traced back to Soranus. The pediatric section of the volume contains much rational advice on infant hygiene and

nutrition, as well as an account of children's diseases, including a recognizable description of rickets. M. F.

SORATA, a mountain peak of the Bolivian Andes, on the east side of Lake Titicaca, 50 mi. northwest of La Paz. It rises to a height of 23,900 ft., a magnificent triple-crested mass whose northern peak is frequently called Illampu. The lower crests of Sorata were scaled by Wiener in 1877, and in 1898 Conway reached the highest summits.

SORBONNE, LA, at Paris, France, formerly a noted theological college, now the College of Science and Letters of the UNIVERSITY OF PARIS. The original Sorbonne was founded in 1253 by a priest, Robert de Sorbon (1201-74). It was governed by a principal, a prior and various *procureurs*, or financial administrators. With uncompromisingly high standards of scholarship, it soon became not only the leading college of theology in Europe, but also the supreme arbitrator, after the *Curia Romana*, on all European questions of religious doctrine. It was instrumental in condemning to death Joan of Arc; later it condemned Luther, Calvin and other "heretics" of the Reformation; and it sent to the flames hundreds of heretical books. It did, however, notably encourage early printing in France. But its power, too dependent upon rigid dogmatism, declined greatly after the Reformation; and the Sorbonne could not be saved merely by the handsome new buildings in which Richelieu re-established it in 1629. Abolished in 1792, it was reopened in 1808 by Napoleon. In 1852 it was incorporated into the University; and in 1885, abandoning theology, it became purely a college of science and letters. The New Sorbonne occupies finely equipped buildings designed by Nénot. It enrolls annually over 10,000 students. The faculty of 139 members was headed by S. Charléty, rector of the University of Paris.

SOREL, ALBERT (1842-1906), French historian, was born at Honfleur, Aug. 13, 1842. After studying law, he secured a position in the foreign office, and also taught at the École libre des sciences politiques. From 1875-1900 he was secretary to the President of the Senate. He is the author of many books, the most important being *Europe and the French Revolution*. In 1894 he was elected to the French Academy. Died in Paris, June 29, 1906.

SOREL, a city of Richelieu Co., and a port of entry, Quebec, Canada, situated on the St. Lawrence and Richelieu rivers, 43 mi. northeast of Montreal. Having a considerable trade in the environs, it is port of call for Quebec-Montreal steamboats. Large wharves and elevators have been built. There also are ship-building yards, iron foundries and machine shops. Sorel occupies the site of a fort erected in 1665 to guard the river route, and is named after Captain de Saurel, the first commandant. Pop. 1921, 8,174; 1931, 10,320.

SORGHUM (*Holcus Sorghum*), a tall, strong, erect annual of the grass family somewhat resembling Indian corn, several varieties of which are of economic importance. While its origin is undetermined

the plant is believed to have been a native of Africa. It has been grown since ancient times in Egypt, China and other warm regions of the Old World where it yields staple food for immense populations. Ages of cultivation have developed numerous valuable varieties. These comprise three classes: 1. the saccharine sorghums with sweet juicy pith cultivated for making syrup and for fodder; 2. the grain sorghums cultivated for their starchy seeds used for food and to some extent for fodder; 3. BROOM-CORN sorghums cultivated for the long, stiff rays of the flowering panicle used for brushes and brooms. The sweet or sugar sorghum (var. *saccharatus*) is grown for syrup in the Southern States, especially from Kentucky and Missouri southward. Among the more important grain sorghums are the KAFIR (var. *caffrorum*), developed in South Africa and grown extensively in Texas, Oklahoma and Kansas; DURRA (var. *Durra*), of the Nile region including the forms known as yellow milo and Jerusalem corn; shallu (var. *Roxburghii*) of Africa and India; chicken-corn (var. *Drummondii*), developed in Guinea, and feterita (var. *caudatus*) of central Africa. In the United States the grain sorghums are grown chiefly as stock and poultry food and for forage.

SOR JUANA INES DE LA CRUZ (1651-95), Mexican nun and poetess, known as Sister Juana Ines de the Cross, was born Juana Ines de Asbaje y Ramirez de Castellana, Nov. 12, 1651, in San Miguel de Nepantla. As a child she attracted the attention of the Viceroy. She assumed the title by which she is famous when, in her 17th year, she took the nun's veil. The strict discipline of the Carmelites, whom she joined during 1667 in the convent of Santa Teresa la Antigua, proved excessive, and 2 years later she changed over to the less exacting order of the Hieronymites. There was a strong commingling of intellectuality and rebellion in the girl, and she has been regarded by historians of Mexican culture, as a pioneer in the movement for Mexican advancement. Sister Ines was a champion for the education of women; she was her country's first feminist, and wished, had her parents consented, to go to the University of Mexico in man's attire; she is also looked upon as the first Mexican folklorist. Her cell became a library, a laboratory and a musical conservatory. By contemporary admirers she was called the "tenth of the Muses." Sister Juana's three volumes of collected verse are posthumous. She wrote plays also, the first having been a *loa*, composed at the age of 7 or 8, in honor of the Holy Sacrament. Much of her work was done under the devitalizing influence of Gongora, and is therefore tainted with conceptual obscurantism, far-fetched metaphors and other stigmata of that great poet. On the other hand, as in the much-quoted *Redondillas* in which she argues against the taste and the censure of men, she shows wit, mundanity and a clear, epigrammatic distinction. Sister Juana died in 1695 in Mexico City. I. G.

SOROLLA Y BASTIDA, JOAQUIN (1863-1923), Spanish painter, was born in Valencia, Feb.

27, 1863. He studied at the San Carlos Academy and in 1884 exhibited at Madrid the *Second of May*, his first successful canvas. The Prix de Rome enabled him to study in Italy and Paris but it was not until he settled in Spain and began to paint his brilliant outdoor scenes that his real talent revealed itself. Although Sorolla executed portraits of the royal family he was not a keen physiognomist. His colorful panoramas of the 49 provinces of Spain, now in the New York Hispanic Society, are well known. Sorolla's reputation rests, however, on his less pretentious impressions of the Valencian seacoast. In these studies of naked, bronzed children, set against a background of glittering sky and sea, the artist achieves a strong effect of brilliant sunlight. Sorolla died at Madrid, Aug. 10, 1923.

SORORATE, marriage with a wife's sister. In some primitive societies the law of sororate requires a woman to marry her deceased sister's husband, so that the existing family organization can be maintained. Under other social systems a husband takes his wife's younger sister as a second, polygynous wife if the first wife is chronically ill or childless. The term is also used of marriage to a deceased wife's sister in more advanced societies.

SORORITIES, COLLEGE. See FRATERNITIES, COLLEGE.

SORREL, SHEEP (*Rumex Acetosella*), a small herb of the buckwheat family with pleasantly acid foliage, called also sour dock. It is native to dry sterile soils in Europe and Asia and naturalized throughout North America where it is often a troublesome weed. The low, smooth, slender stems bear narrowly hastate leaves and small greenish-yellow flowers in erect clusters.

SORREL TREE (*Oxydendrum arboreum*), a medium-sized tree of the heath family, called also sourwood. It is native to woods from Pennsylvania to Indiana south to Florida and Louisiana, and sometimes planted for ornament. The smooth-barked trunk, sometimes 60 ft. high, bears slender branches, oblong, sour leaves, numerous urn-shaped white flowers in terminal clusters and a dry capsular fruit containing numerous seeds.

SORRENTO, a town of southwestern Italy in the province of Naples, situated on the Bay of Naples amid luxuriant lemon and orange gardens, on a cliff rising abruptly about 160 ft. above the sea. It is the seat of an archbishop and has Roman remains, a 15th century cathedral restored in 1924, the Basilica Sant' Antonio, and a museum. Sorrento was the birthplace of TORQUATO TASSO, whose statue adorns the piazza. The ancient *Surrentum*, the town was famous for its wine in Roman times and was important in the Middle Ages. The people engage in fishing and cater to tourist traffic. Pop. 1931, 26,324.

SOSNOWICE or SOSNOWIEC, a city in the Polish voievodship of Kielce, 35 mi. west of Cracow. It is a center of Polish coal mining and is a rapidly growing factory town, with coal mines, coke ovens, steel works, rolling mills, metal and textile industries.

Sosnowice was a remote village until 1879, when it began to develop industrially. The value of its production before the World War amounted to 20 million rubles. Est pop. 1930, 103,441.

SOTER, ST., bishop of Rome, 166-175, whose pontificate embraced the last part of the reign of Marcus Aurelius, after whose death began the period of military anarchy from Commodus to Diocletian.

SOTHERN, EDWARD HUGH (1859-), American actor, was born at New Orleans, La., Dec. 6, 1859, son of the late E. A. Sothorn of "Lord Dunsreary" fame. His father, opposed to a stage career for his son, educated him in England with a view to his becoming a painter. However, he appeared on the stage, in his father's company, at the Park Theatre, New York City, in 1879 as the cabman in *Uncle Sam*. After making a reputation in light comedy and romantic rôles, in 1904 he joined forces with JULIA MARLOWE, their association, in Shakespearean and costume plays lasting, with intervals, until 1924. Apart from his Shakespearean parts, his best known performances were in *Lord Chumley*, 1888, *The Prisoner of Zenda*, 1895, *An Enemy to the King*, 1896, *The Sunken Bell*, 1900, and *If I Were King*, 1901. They were married Aug. 17, 1911.

SOTO, FERDINAND DE. See DE SOTO, FERDI-

SOUARI NUT, the large nutlike edible seed of a South American timber tree (*Caryocar nuciferum*) of the caryocar family, called also butternut. The tree, which grows 100 ft. high producing valuable ship timber, bears trifoliate leaves, showy purple flowers and a huge woody fruit containing hard-shelled, kidney-shaped, warty nuts with white oily kernels possessing an almond-like flavor.

SOULT, NICOLAS JEAN DE DIEU, DUKE OF DALMATIA (1769-1851), French marshal, was born at Saint-Amans-la-Bastide in the Department of Tarn, Mar. 29, 1769. He entered the French army as a private in 1785, and distinguished himself in the French Revolutionary War, especially in Switzerland under Masséna in 1799 (when he was made general of division), and the siege of Genoa (1800). In 1804 he was made marshal by Napoleon Bonaparte, whose ablest tactician he was, and fought at Austerlitz, Jena, Prussian Eylau (after which he was made Duke of Dalmatia), and thence in 1804-14 in Spain, with varying success, as commander-in-chief of the French forces against the British in the Peninsular Campaign. Upon the fall of Napoleon he espoused the cause of Louis XVIII, whose minister of war he became and whom he abandoned again upon Napoleon's return from Elba in 1815. Soult was made chief of staff by Napoleon and served under him through the Hundred Days, culminating in the disaster of Waterloo, after which he was banished. He was recalled again in 1819, receiving his former position and being made peer in 1827. Soult was minister of war of Louis Philippe in 1830-34, being also premier from 1832; during 1839-40 he was liberal foreign minister; again premier, 1840-47, and at the same time minister of

war from 1840 to 1846. In 1847 he was made marshal general of France, and retired from active life. He died at his castle of Soultberg in Tarn, Nov. 26, 1851.

SOUND, either the sensation produced by the stimulation of the auditory nerve or the physical cause of that stimulus. In the latter sense, sound is any undulatory motion of the air, or other elastic medium, capable of producing the sensation of hearing. Such motion in a medium arises from the successive vibration of the particles of the medium, this motion being transmitted from particle to particle with a definite velocity. In a fluid medium through which a sound wave is passing, the density and pressure at any point are alternately greater and less than the normal pressure. The distance between the two closest points at which the condensations or the rarefactions are simultaneously a maximum or a minimum is the WAVE-LENGTH of the sound, and the total number of complete cycles of pressure at any point in one second is the FREQUENCY of the sound.

Intensity of sound is the energy per second passing through a unit area of a progressive sound wave. It is proportional to the square of the product of the frequency and amplitude of the vibrating particle. Loudness is the magnitude of the subjective response to the intensity of a sound. There is no absolute loudness of a sound but only a difference in loudness of two sounds. The sensation of loudness depends both upon the intensity and the frequency of the sound.

Loudness in Decibels	Physical Intensity	Example
0	1	Barely audible
10	10	Whisper at 5 ft.
20	100	Quiet room
		Quiet out of doors
30	1,000	Quiet office
40	10,000	Quiet conversation
50	100,000	Noisy office, ordinary conversation at 5 ft.
60	1,000,000	Loud conversation
		Busy city traffic
70	10,000,000	Loud radio music
80	100,000,000	Very loud radio music
		Subway train
90	1,000,000,000	Pneumatic drill
100	10,000,000,000	Airplane motor 10 ft.

For a sound of a given PITCH, the change of loudness, measured in steps of barely perceptible loudness, is roughly proportional to the change in the logarithm of the physical intensity. The DECIBEL scale of loudness is based on this fact. The zero of such a scale is the loudness of a sound that is barely audible, and the loudness of any sound is measured in decibels above this threshold of audibility. The preceding table gives the loudness in decibels above the threshold and the relative physical intensities of some ordinary sounds.

See also MUSICAL SOUNDS; INSULATION, SOUND; VELOCITY OF SOUND.

P. E. S.

SOUND, BATTLE OF THE, one of the series of indecisive conflicts in the Scandinavian Seven Years'

War during 1563-70. For a century the strip of water called the Sound, the strait between the island of Danish Zealand and Sweden, connecting the Baltic and North seas, was a source of controversy between Denmark, which claimed right to collect tolls on shipping in the Sound, and Sweden and Lubeck, head of the Hanseatic League. In 1563 the Swedes attacked and defeated a Danish fleet off Bornholm, a Baltic island 25 miles south of the Swedish coast. Denmark was joined in land campaigns by Lubeck and Poland; but the military victories of the coalition were evenly balanced by the naval achievements of Klas Kristersson Horn, the Swedish admiral who dominated the Baltic, and levied duties on all ships passing through the Sound. Denmark and Sweden made peace in 1570, and the rights to collect duties on the Sound reverted to the former.

SOUNDING AND DREDGING, DEEP-SEA, constitutes the only way in which the contours and depths of ocean basins may be ascertained, and information secured concerning the forms of life existing at great depths. In modern sounding apparatus a steel wire has replaced the old hemp rope. This makes possible quicker work and greater accuracy of the results, since the wire may be lowered by a sounding machine at the rate of 100 fathoms a minute, and, being much thinner, offers less resistance against currents. While making soundings, ships usually face intermediate between the wind and the current, so that the sounding line may remain vertical. The apparatus lowered during a sounding usually contains a thermometer, as well as a contrivance which automatically scoops up a specimen of the deposit on the ocean floor. The lead weight by which the whole is lowered is automatically released upon touching bottom, thus enabling one to judge accurately the greatest depth reached. In dredging for animals use is made of a steel wire net, which after having been dragged over the bottom for some distance is closed by releasing a catch from above.

Another method of sounding makes use of the propagation of sound waves through water. An explosion is set off near the surface, and the time measured which is required by the sound wave to travel to the ocean bottom and back. This method gives very rapid results, as even at the greatest known ocean depth, some 5,700 fathoms, the sound waves take considerably less than a minute for the double journey. The time required to make a sounding at the same depth with wire was nearly 10 hours.

SOUND INSULATION. See INSULATION, SOUND.

SOUNDNESS TESTS. See CEMENT TESTING; ROCK TESTING.

SOURSOP (*Annona muricata*), a small evergreen tree of the custard-apple family, known also as guanabana, cultivated for its edible fruit. It is a native of tropical America, widely naturalized in other tropical regions. The large, juicy, dark green fruit, sometimes weighing 5 lbs., is used as a flavor in beverages and for making jellies and preserves.

SOURWOOD, a name given to an ornamental

tree of the heath family, native to the southeastern United States called also sorrel tree.

SOUSA, JOHN PHILIP (1856-1932), American composer and bandmaster, was born at Washington, D.C., Nov. 6, 1856. At the age of 17 he began conducting for traveling theatrical troupes and in 1880 became bandmaster of the United States Marine Corps, serving in that capacity until 1892, when he organized his own band with which, in 1910, he toured the world. He wrote a number of comic-operas, but acquired most of his repute as a composer on the basis of his military marches, among them *Liberty Bell*, *The High School Cadets*, and *The Stars and Stripes Forever*. King Edward VII decorated him with the Victorian Order. Sousa died at Reading, Pa., Mar. 6, 1932.

SOUTANE, in the Catholic Church, the usual name of the long, narrow-sleeved garment of clerics, called Cassock.

SOUTH, UNIVERSITY OF THE, Sewanee, Tenn, a college of arts and sciences, with a graduate school of theology attached. It is in part coeducational, and is under the control of the Protestant Episcopal Church in 13 Southern States. It was founded in 1857. The endowment available for operating amounts to \$1,250,000, and an additional \$1,000,000 in trust funds and annuities. In 1931 the students in the college numbered 281, in the school of theology, 23. The teaching staff totaled 34, headed by Vice-Chancellor Benjamin F. Finney.

SOUTH AFRICA, UNION OF, a federation of four British colonies (new provinces), CAPE OF GOOD HOPE, TRANSVAAL, NATAL and the ORANGE FREE STATE, into a self-governing British dominion. The provinces extend from the southernmost point of Africa to the course of the Limpopo River. The coasts are washed by the Atlantic and Indian oceans.

The area of the provinces and their population, 1921, were:

Provinces	Area in Sq. Mi.	Europeans 1931	Natives, and others.
Cape of Good Hope...	276,536	748,455	2,132,110
Transvaal	110,450	695,963	1,544,151
Natal	35,284	177,424	1,038,189
Orange Free State...	49,647	205,324	440,271
Total.....	471,917	1,827,166	5,409,092

The total population in 1930 was estimated at 8,003,697, including 1,798,647 Europeans. The relations of the black and white populations vary. In the Cape and Natal natives are permitted under certain conditions to vote; north of the Orange River this measure of equality is denied. In the Transvaal there is legal sanction to a "color bar" reserving skilled labor to the white. The native Bantu people are the chief source of labor everywhere.

Surface Features. The interior plateau of South Africa has the form of an inverted saucer with its outer edges corresponding roughly to the coast line. The Lebombo Range, the northern extension of the

Drakensberg Mountains, is the most important system in the Union. The latter range runs from the north-west corner of Natal, then forms with its outposts the mountainous country of Basutoland, and is continued through the Cape Province under a variety of names. The highest peaks are Champagne Castle, 10,357 ft., Mountaux Sources, 10,000, and Giant's Castle, 9,657. This series of ranges incloses on the north and east the great inland plains, and the west is inclosed by ranges from a continuation of the system in the southwest. There is a limited amount of coastal lowland. About 40% of the Union is high plateau above 4,000 ft. in elevation.

Rivers, with a good supply of water all through the year, are found only among the relatively short streams of the south and southeast, from the Breede to the Tugela. Both these and the larger rivers have a negligible value for navigation. The LIMPOPO, 1,000 mi. long, drains the greater part of the Transvaal. The ORANGE, 1,200 mi. in length, traverses South Africa from east to west. The Vaal is the chief tributary of the Orange. All South African rivers are obstructed by silt, and as sheltered bays are rare there are very few good harbors. There are no large lakes.

Climate. South Africa is much cooler than other countries in the same latitude mainly for the reasons that most of the plateau is 4,000 ft. above sea level, and the west and south coasts are washed by cold currents flowing northwards from Antarctica.

Minerals. The mineral industry is the most important in the Union. South Africa produces more than half the world's total annual output of gold and is the premier producer of diamonds, in fact almost the only source of diamonds. Gold was known to occur in South Africa in ancient times, but the rich Witwatersrand ridge was not discovered until 1885. The first mining company was founded in 1863 to work the Namaqualand copper area. The first diamond was discovered accidentally, and in 1873 the first mined gold was won. There were extensive developments when gold was discovered in the ranges of the Transvaal, and on one of them, the Rand, the town of JOHANNESBURG was built in 1886. Since 1908 the Transvaal's proportion of gold output has increased from one-third to approximately one-half of the total annual output of the world, but in recent years it appears to be declining. The most famous diamond field is at KIMBERLEY, where diamonds were first found in 1871, but the largest mine is near PRETORIA. Coal is important; being cheaply mined, it has enabled many gold mines to be worked at a profit. The best copper ore seems to have given out. Other minerals known to occur in South Africa are tin, iron, asbestos, lead, mica, zinc and nickel. It has come to be recognized that the high mineral output of South Africa is possible only because of the cheap unskilled labor available. Over 300,000 colored natives are employed in the mines.

Agriculture. Next to the mining of gold and diamonds, farming is by far the most important occupation in South Africa. The outstanding crop is

maize (Indian corn or mealies), the production of which has increased sixfold since the beginning of the century. Although some is grown on most farms of the Union, as a commercial crop it comes chiefly from the Transvaal and Orange Free State. Maize, or mealies, is the staple native food. Large quantities of maize are ground into maize meal, but it is less used by Europeans than in the United States, where corn flour made from maize is very popular. Natal produces more than the total amount of sugar required by the Union. Tobacco and cotton are grown.

The fruit-growing industry is now very important in South Africa. Citrus fruits, stone fruits, apples, pears, grapes and many kinds of tropical fruits are successfully produced. Large quantities are exported to Britain.

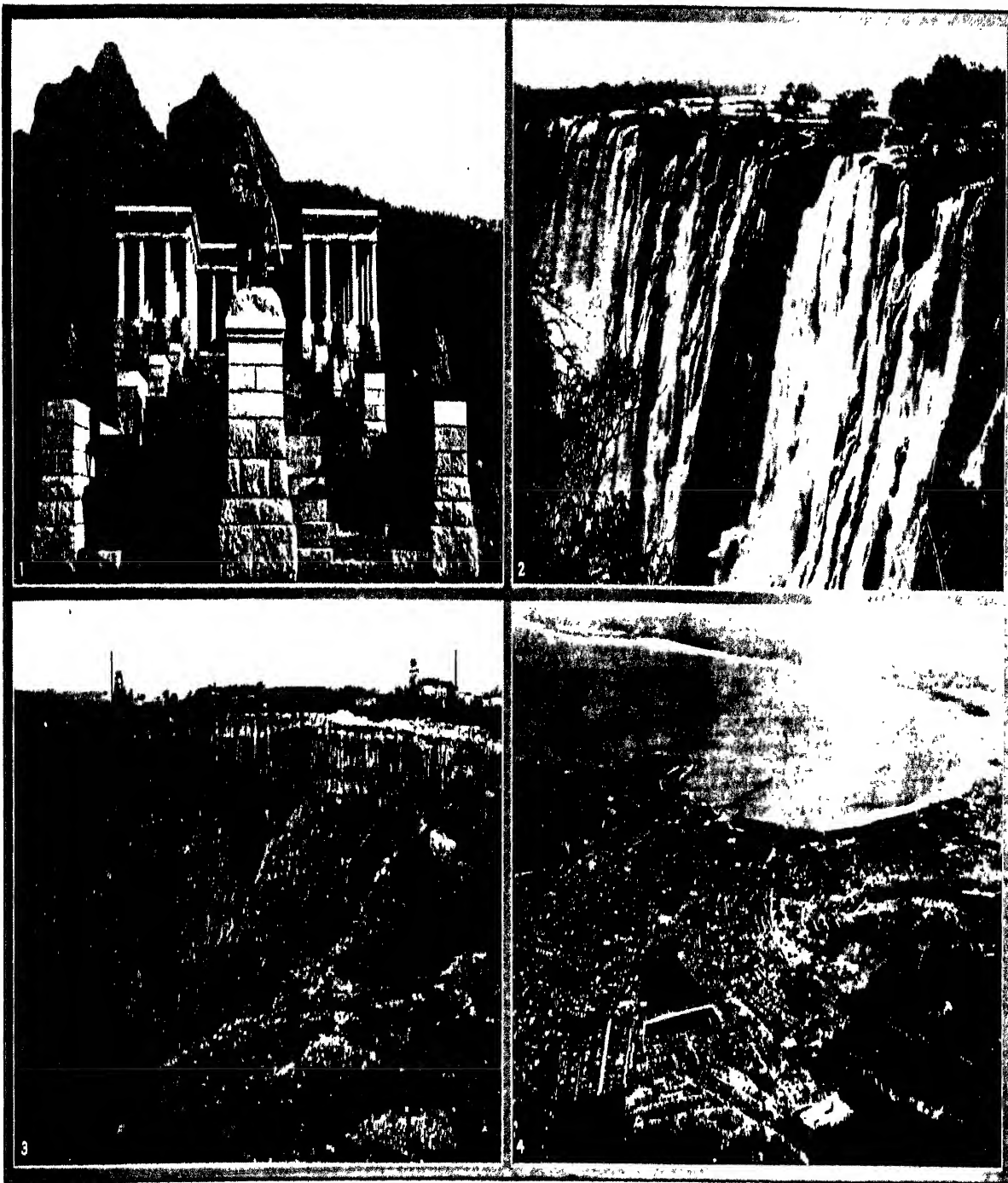
Livestock. Sheep are well distributed over the Union except in the wetter parts of Natal and northern Transvaal. The original Cape sheep were inferior, but the importation of sheep from Holland and Britain and more recently from Australia, has improved the stock. South Africa is one of the five great wool-producing countries of the world. Exports average about 200,000,000 lbs., worth in recent years approximately \$50,000,000. Cattle are bred for the production of beef, milk and butter and as beasts of burden.

Farming by Europeans depends on the labor of native "boys" and the use of the ox as a draught animal, although the donkey and the mule or the tractor are tending to displace the ox. The World War caused a great change in ostrich farming. The production of ostrich feathers was an important industry, but feathers were considered a useless luxury during the war and women's fashions changed. The annual export trade fell from about \$15,000,000 to less than \$1,000,000, but in 1931 an upward increase was reported because of the swing back to feathers as a hat ornament. Angora goats, which have been successfully established, are not so numerous as native goats, numbering but 2,500,000 out of a total of 8,000,000 in 1926. Their number varies with the rainfall, the variation having a corresponding effect upon the export of mohair.

Forests. The country is poor in natural forests. There is a small area of cedar in the Cedarberg Mountains north of Cape Town, and there are some sub-tropical forests on the coasts which yield several varieties of fine hard timber. Foreign trees, eucalyptus, wattle and pine, have been planted in many parts of the country, especially by mining companies, towns and the government.

Fisheries. Important fish include the Cape salmon, hake, herring, mackerel, sole, oysters and crayfish. There is a considerable canning and export trade to France and Australia. Whaling is important in Antarctic waters; Durban, Natal, is the chief center of the industry.

Education. Primary and secondary education is arranged by the different provinces. Several universities and colleges are under the supervision of a minister of education.

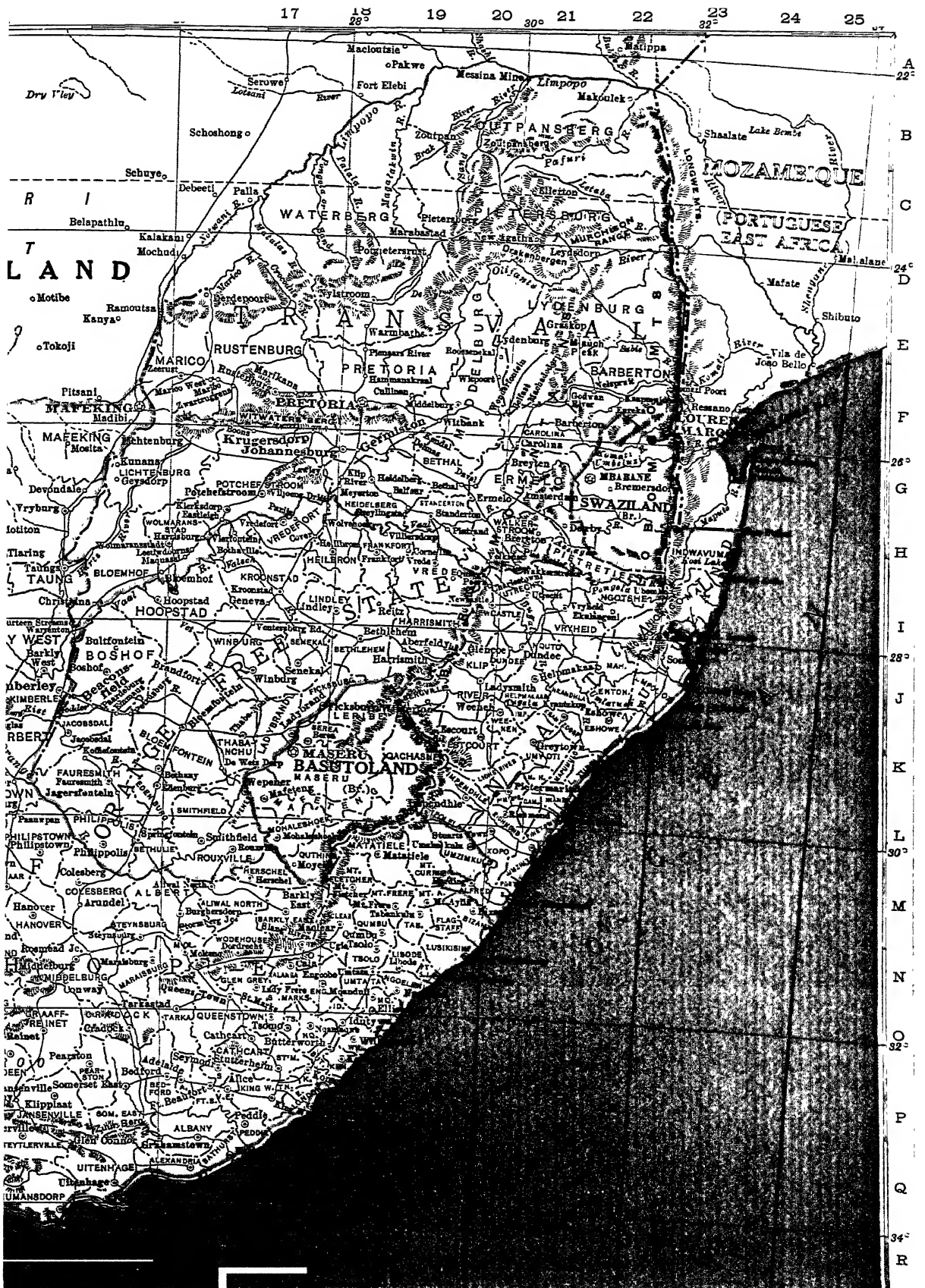


COURTESY SOUTH AFRICAN RAILWAYS AND HARBOUR

MODERN DEVELOPMENT AND SCENIC VIEWS IN SOUTH AFRICA

1. Memorial to Cecil Rhodes at Cape Town, Cape Province, Union of South Africa. The memorial, symbolizing physical energy, was designed by the English sculptor, G. F. Watts. 2. Victoria Falls, Rhodesia. At a point about midway in its course, the Zambesi River falls 400 feet into a chasm 300 yards in width, forming the world's greatest waterfall. 3. Open workings in a diamond mine at Kimberley, Cape Province. 4. Aerial view of the city of Cape Town, the oldest settlement of the Union of South Africa.





Government and History. Pretoria is the center of governmental administration, but the legislature sits at Cape Town. Included under the administration of the Union is the mandated territory of SOUTH-WEST AFRICA, formerly German South-West Africa. The territory of the Union surrounds Basutoland and almost surrounds Swaziland.

When gold was discovered on the Rand, British miners poured into the Boer country, and trouble arose when these "outlanders" (those who were not Boers) rebelled because they were allowed no share in the government of the country. Dr. L. S. Jameson with 500 Rhodesian Police attempted to aid them in 1895. War between the Boers and British soon followed, and in 1900 the Transvaal and Orange Free State were again annexed to the British Empire. In 1910 the Union of South Africa was formed. *See SOUTH-AFRICAN WARS.*

HISTORY

In 1908 a National Convention (Oct. 1908-Feb. 1909) of Cape Colony, Natal, the Transvaal and the Orange Free State met first at Durban, later at Cape-town, and drafted the South African Act which was soon adapted by all as a Constitution. Thereupon the British Parliament passed an act establishing the Union of South Africa, May 31, 1910. Viscount Gladstone, son of the great statesman, was the first governor general and high commissioner, with Gen. Botha as premier. Certain difficulties in founding the new Government were met with a spirit of compromise. English and Dutch were both adopted as official languages. Rival claims as to the capital were reconciled by making Pretoria the seat of the administration, Bloemfontein that of the judiciary, and Cape-town the meeting place of Parliament. Qualifications for voting were left to the provinces, where the natives were disfranchised except in the Cape, which maintained educational tests.

Gen. Botha as premier had the support of his devoted friend, Gen. Smuts, and of most of the Boers in a liberal policy of loyalty to the new arrangements, the blending of the two European races into one Africander people, and South African progress within the British Empire. In 1911 the South African party was founded, though Gen. Hertzog and his supporters distrusted the British and favored Boer predominance. After a Cabinet crisis in 1912 Botha formed a new ministry from which Hertzog was excluded, and the following year a minority led by the latter and De Wet withdrew from the South African party and founded the Nationalist or Dutch Party. As a result, Botha came to cooperate with the Unionist Party, which was largely British in its interests. Difficulties with Asiatic labor, particularly in the Transvaal, where Gandhi had been a leader, was a leading cause of this acute disagreement, for as usual, Botha favored a more conciliatory policy than did his opponents.

In 1913 a strike among the miners on the Rand became so serious that imperial troops had to be

called upon to defend Johannesburg. The following year a general strike was so sternly suppressed by Smuts as Minister of Defense that he incurred the lasting hostility of the rapidly growing Labor Party. When the World War broke out Botha and Smuts had to overcome a Boer rebellion before they were able to conquer German Southwest Africa, 1915, a mandate for the administration of which was later given to South Africa by the League of Nations. Both generals took an important part in the Paris Conference and signed the treaty as representatives of the Union.

After the death of Botha in 1919, Smuts succeeded him as premier. Opposed by many of the Dutch, and bitterly disliked by the Labor Party, he formed a coalition with the Unionists after the elections of 1920 left him with a minority in the House. Soon Hertzog and the Nationalists formed a close alliance with the Labor Party, both finding common ground in their repressive policy toward the natives. When their coalition came into office in 1924, Hertzog as premier carried further the measures which Botha and Smuts had undertaken for the improvement of conditions of labor, and proposed a native policy which emphasized the separation between the races. A bill prohibiting natives and Asiatics from competing with Europeans in skilled or semi-skilled work was passed in 1926. The Flag Bill of the same year threatened to disrupt the Union until a compromise was effected by which the Union Jack was retained for symbolic use with the new national flag. A commercial treaty giving Germany most-favored-nation concessions was declared in force by Hertzog in 1929, though the Senate had refused ratification. In the elections of 1929 both the Nationalists and the South African Party increased their representation at the expense of the Labor Party. A. L. L.

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SOUTH AFRICA, UNIVERSITY OF, a Federal university at Pretoria, South Africa, founded in 1873 as the University of the Cape of Good Hope. This institution on its foundation was patterned after the London University, as a purely examining body. In 1918 it was incorporated as the University of South Africa. Its constituent colleges include Grey University College at Bloemfontein, Huguenot University College at Wellington, Natal University College at Pietermaritzburg, Potchefstroom University College at Potchefstroom, and Rhodes University College at Grahamstown. In 1930-31 there were 3,093 students enrolled. The chancellor in 1931 was Field Marshall H.R.H. the Duke of Connaught and Strathearn.

SOUTH AFRICAN WAR. *See BOER WAR.*

SOUTH AMBOY, a city of Middlesex Co., N.J., located on the south side of the Raritan River facing Perth Amboy. It is the southern terminus of the Victory Bridge, an important link in the highway system between New York City and the Jersey shore

resorts. The city is served by the Central of New Jersey, Raritan River, and Pennsylvania railroads. Its industrial establishments include large power plants and terra-cotta works. The city ships large quantities of coal. Pop. 1920, 7,897; 1930, 8,476.

SOUTH AMERICA, a continent of the Western Hemisphere, situated mostly south of the Equator. It is joined to North America on the northwest by the Isthmus of Panama, and bounded on the north by the Caribbean Sea. The Pacific Ocean lies on the west, and on the east the Atlantic surrounds the shield-shaped extension of the upper half of the continent and gradually closes in upon the lower half, reducing it to a narrow headland at the southern extremity. The greatest width of the land is 3,200 mi. between Pernambuco at 34° 51' W. and Parina Point at 81° 30' W. long. and the maximum length, 4,550 mi. between Punta Soldado at 12° 23' N. and Cape Horn at about 56° S. lat. Within these limits its area is approximately 7,500,000 sq. mi. which is 1,000,000 sq. mi. less than the area of North America. Its coast line is remarkably regular with no deep indentations and with but few inlets for harbors. The only larger islands included with the continent are the Falkland group, Trinidad and the Galapagos. The Juan Fernandez Islands, lying well out in the Pacific at 80° W. long., are a possession of Chile. Beginning about 40° S. lat. and extending to Cape Horn, the coast of Chile is broken up into a complex system of bays, inlets and island groups, chief of which are the Island of Chiloé and Tierra del Fuego.

Surface Features. The structure is similar to that of North America in that the long, high uplift of the Andes runs along the western margin, a comparatively low, irregular series of highlands is situated near the eastern coast, and a broad plain lies between. The surface has a mean altitude of 1,300 ft. above sea level. The lowest position is sea level and the maximum elevation Mt. Aconcagua, 22,867 ft. on the boundary between Chile and Argentina.

The Andes are mountains of titanic proportions. For a distance of over 4,000 mi. they form a massive wedge-shaped rampart, wide at the north and narrowing to a single chain which declines to the level of the sea at the southern end. Their loftiest pinnacles, including Mt. Aconcagua, 22,867 ft.; Mt. Sajama in Bolivia, 22,349 ft.; Mercedario in Argentina, 22,302 ft., and Huascarán in Peru, 21,812 ft., are surpassed only by the Himalayas. Several of the peaks are gigantic volcanoes such as Chimborazo 20,702 ft., Cotopaxi 19,550 ft. and Antisana 19,260 ft., all in Ecuador; and Misti in Peru, 20,013 ft. Lake Titicaca, the largest on the continent, with an area of 3,200 sq. mi., occurs on the boundary between Peru and Bolivia at an elevation of 12,506 ft. Near its shores are ruins of temples and other relics of an ancient civilization.

Between the Andes and the sea there is a low coast range. It is weak in the north but in Chile rises steeply from the shore for over 1,500 mi. before it breaks into fragments comprising the islands of the Chilean archipelago.

The Eastern Highlands are a subdued mountain system, interrupted at the north by the Amazon River valley. In Venezuela there is a knot of ridges and in Guiana an area of highlands of which little is known because of their inaccessible character. They rise to 11,000 ft. and are deeply cut by river gorges. In Brazil south of the Amazon there is a vast expanse of plateau covering nearly 1,000,000 sq. mi. which is similar in a general way to the plateaus of South Africa and the Deccan of India. It is densely populated only near the coastal margin, while the vast interior is even now only partially explored. This plateau is rimmed along the Atlantic coast by mountains, the maximum elevation of which is about 9,000 ft.

The lowlands between the two mountain systems extend from the Caribbean Sea southward to the Rio Colorado in Patagonia and are drained by three large rivers. The region along the northern coast is the basin of the Orinoco River which rises in the Andes and flows eastward 15,000 mi. before emptying into the Atlantic through a swampy delta. The trunk stream is navigable to a cataract 870 mi. from its mouth and with its numerous tributaries provides 4,300 mi. of waterways. The plains of this basin are chiefly pasture lands known as llanos. They are scarcely anywhere over 800 ft. above sea level and, owing to their gentle slope, become inundated in the rainy season.

Separated from the llanos by the plateau of Guiana is the basin of the Amazon, the gently undulating surface of which is composed of vast deposits of lacustrine silts and clays dropped in the bed of a great inland lake, now entirely drained by the Amazon and its tributaries. This is the greatest expanse of tropical rain forest, or selva, found anywhere in the world. The river has the largest basin, 2,500,000 sq. mi., and greatest volume of any stream in the world. From its source in the Andes it flows eastward 3,400 mi. to the Atlantic and discharges through an estuary that expands to 150 mi. at its mouth. Several of its tributaries are in themselves major rivers, as the Rio Negro on the north, the Purus, Madeira, Tapajos, Xingu and Tocantins on the south. The main stream is navigable 2,300 mi. for ocean steamers, and the system has in all 27,000 mi. of waterways. The Amazon River system is a significant factor in the development of the country since it is almost the only means of inland travel.

The great plateau of Brazil provides the water-parting between the Amazon basin and the plains of the Plata-Paraná river system. The latter body consists of the Uruguay and Paraná-Paraguay rivers, together measuring 2,500 mi., which flow southward and unite in the estuary called the Rio de la Plata which is 135 mi. wide at its outlet. The upper reaches of the Alto-Paraná and the Paraguay drain the widespread grazing pastures or campos of the Brazilian plateau. Within a radial distance of 350 to 400 mi. from Buenos Aires there is an exceedingly level, treeless expanse known as the Pampa. This 250,000 sq. mi.

is an area of remarkable productivity and the finest agricultural land of South America, yielding immense crops of wheat, corn and other staples.

South of the Pampa is the plateau of Patagonia, a semi-arid tableland with a maximum elevation of 5,000 ft. Its vegetation, consisting chiefly of sagebrush, is scanty, leaving most of the surface exposed to the erosive action of the violent winds which sweep over it. The northern part is a desert region which continues through northern Argentina, crosses the Andes at about 27° S. lat. and extends northward along the coast to the Gulf of Guayaquil. The continent ends in the archipelago of Tierra del Fuego which is separated from the mainland by Magellan Strait.

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Climate. The continent of South America is broadest in the lower latitudes where temperature and humidity are generally high, and it tapers toward the south where the cooler climates of middle latitudes are found. Five chief kinds of climate exist in South America. The first is the tropical rainy climate of the Amazon, characterized by constantly high temperatures and copious rainfall. Manáos, 3° S. lat. averages 78° F. in its coolest month and 81° in the warmest, a range of only 3°. Its annual rainfall is 65 in. Farther from the Equator the rainfall, instead of being abundant in all months, is concentrated more and more in the warmer season, while the cooler season becomes very dry, as on the Brazilian plateau or the Orinoco llanos. The second climatic type is that of the high mountains. Increased altitude brings cooler temperatures, but an even greater monotony than in the lowlands. Bogotá, at an elevation of over 9,000 ft., has a mean temperature of 56°, but a range between the coldest and warmest months of less than 1° F. The third type is the desert. This lies west of the Andes along the Pacific Coast from the northern boundary of Peru southward as far as 30° S. lat. in Chile; between latitudes 20° and 30°, roughly, it crosses the mountains and extends southward on the eastern side. Patagonia is very dry and is always cool. The Atacama Desert of northern Chile is one of the driest deserts in the world. The fourth type of climate is the middle latitude type with mild winters, similar to our southeastern states. This lies in southern Brazil, Uruguay and the Argentine Pampa. Buenos Aires, for example, has the same winter temperature as Charleston, S.C., but is not so hot in summer and has the same summer temperature as New York, but is not so cold in winter. The fifth climatic type occurs in the far south, especially on the west coast of middle and southern Chile. Here

there are very heavy rains, and cool summers and mild winters.

Fauna. The continent of South America together with Central America, the tropical lowlands of Mexico and the West Indies, forms a distinct zoological division, the Neotropical region. Except for a comparatively small area, this region lies entirely within the tropics. It possesses a fauna of great richness and variety but entirely different in character from that of North America.

This fauna is remarkable not only for the large number of animals not found elsewhere, but also for the important groups of animals which are not represented. Among the groups mammals found only in the Neotropical region are the sloths, anteaters, chinchillas, agoutis, guinea-pigs, vampire bats, marmosets and spider monkeys. On the other hand, the region contains no native horses, oxen, sheep, goats, elephants, pikas, civets, moles, fruit-bats, lemurs or anthropoid apes. The tapir is the largest land mammal; the other important ungulates are the guanaco and the vicuña, domesticated as the llama and the alpaca. Among the carnivores are the jaguar, jaguarundi and ocelot. Various wild dogs occur, but wolves and foxes are absent. The spectacled bear of the Andes is the only representative of the bears. Distinctive rodents, besides the agoutis and guinea-pigs, are the capybara and coypu; armadillos and peccaries are widely distributed.

The bird fauna, the most striking and diversified found in any tropical region, contains an immense number of species, most of which, except the migratory forms, do not occur in other regions. Of some 500 species of hummingbirds, less than 25 migrate as far as North America. Besides the hummingbirds, there are other large groups noted for their resplendent plumage. Characteristic of these are the macaws, sugar-birds, toucans, cotingas, tanagers and trogons. Among the larger game birds are the curassows, guans and tinamous. The ostrich group is represented by rheas. The condor is the largest bird of prey.

The reptiles include the boa, anaconda, and various venomous serpents of the rattlesnake group; the crocodile, alligator, cayman, and numerous iguanas. The fresh-water fishes, which are exceedingly numerous, include the electric eel and the lung-fish of the Amazon.

Flora. The humid tropical regions of South America, embracing the major part of the continent, are especially adapted for the growth of luxuriant vegetation. This reaches its greatest development in the valley of the Amazon, which contains the largest area of tropical forest in the world, extending in a broad belt from the Atlantic through the central lowlands to the base of the Andes and up their eastern slopes to an elevation of 3,000 ft. This great forest is notable not only for its density and the size and height of its trees, but also for its extreme variety, a single acre sometimes yielding 100 species of trees, most of which are found only in South America. Intermingled with this forest growth, usually more

than 100 ft. in height, is an immense number of climbing and trailing lianas, with strong, cable-like stems, and a profusion of orchids, bromelias and other epiphytes, often forming impenetrable jungles. These tropical forests, called *silvas*, comprise the densest vegetation on the globe. Among the most conspicuous trees are the palms, which attain their finest development in this region. The tallest members of the forest are the Brazil nut and the silk-cotton tree; these probably never exceed 200 ft. in height.

Bordering on the lowland forests are the *catingas* or "light woods" region, with a dry climate, low trees and thorny shrubs. On the higher and drier plains there are extensive savannas, called *llanos* in Venezuela and *campos* in Brazil. These are parklike areas covered with coarse tall grasses and scattered trees. On the high tablelands of southern Brazil there are forests of *araucaria* or Chile pine.

In the La Plata region are the pampas, broad plains somewhat resembling North American prairies, but with more luxuriant grasses. At the south the pampas merge into the arid steppes of southern Argentina and Patagonia, with scant and stunted vegetation.

On the eastern slope of the Andes there is a succession of plant zones from the tropical vegetation at the base to alpine vegetation above timber-line, giving a flora of exceeding richness and variety. Except at the north the western slopes of the Andes are arid, descending into almost rainless areas, as the Atacama desert, with very scant vegetation.

South America has contributed to the world many important economic plants. Among these are the potato, maize, tobacco, tomato, manioc, maté, cacao, Para rubber tree, cinchona, coca and numerous valuable woods.

Political Divisions. The 13 countries of South America consist of ten republics and three small colonies. With their areas they include the United States of Brazil, 3,275,510 sq. mi.; Argentina, 1,153,119 sq. mi.; Peru, 530,047 sq. mi.; Bolivia, 514,155 sq. mi.; Colombia, 447,536 sq. mi.; Venezuela, 393,874 sq. mi.; Chile, 290,119 sq. mi.; Ecuador, 109,978 sq. mi.; Uruguay, 72,153 sq. mi.; Paraguay, 61,647 sq. mi.; British Guiana, 89,480 sq. mi.; Dutch Guiana, 54,290 sq. mi.; French Guiana, 34,740 sq. mi. See separate articles for population figures.

The Falkland Islands, a British crown colony, consist of almost 100 islands but only two are inhabited. The estimated population is 3,510. Galapagos Islands, a dependency of Ecuador, have an area of 2,400 sq. mi. and about 400 people. Trinidad, belonging to the British Empire, has an area of 1,863 sq. mi. and about 345,000 people.

The number of inhabitants on the continent and islands is approximately 80,856,000. Of these the majority are mestizos, a mixture of white races, mostly Spanish and Portuguese, and native Indians. Possibly one-fifth of the total is pure Indian, and those of unmixed white origin are very few. The latter predominate in Argentina and comprise almost the whole population of Uruguay. Those of pure Indian descent

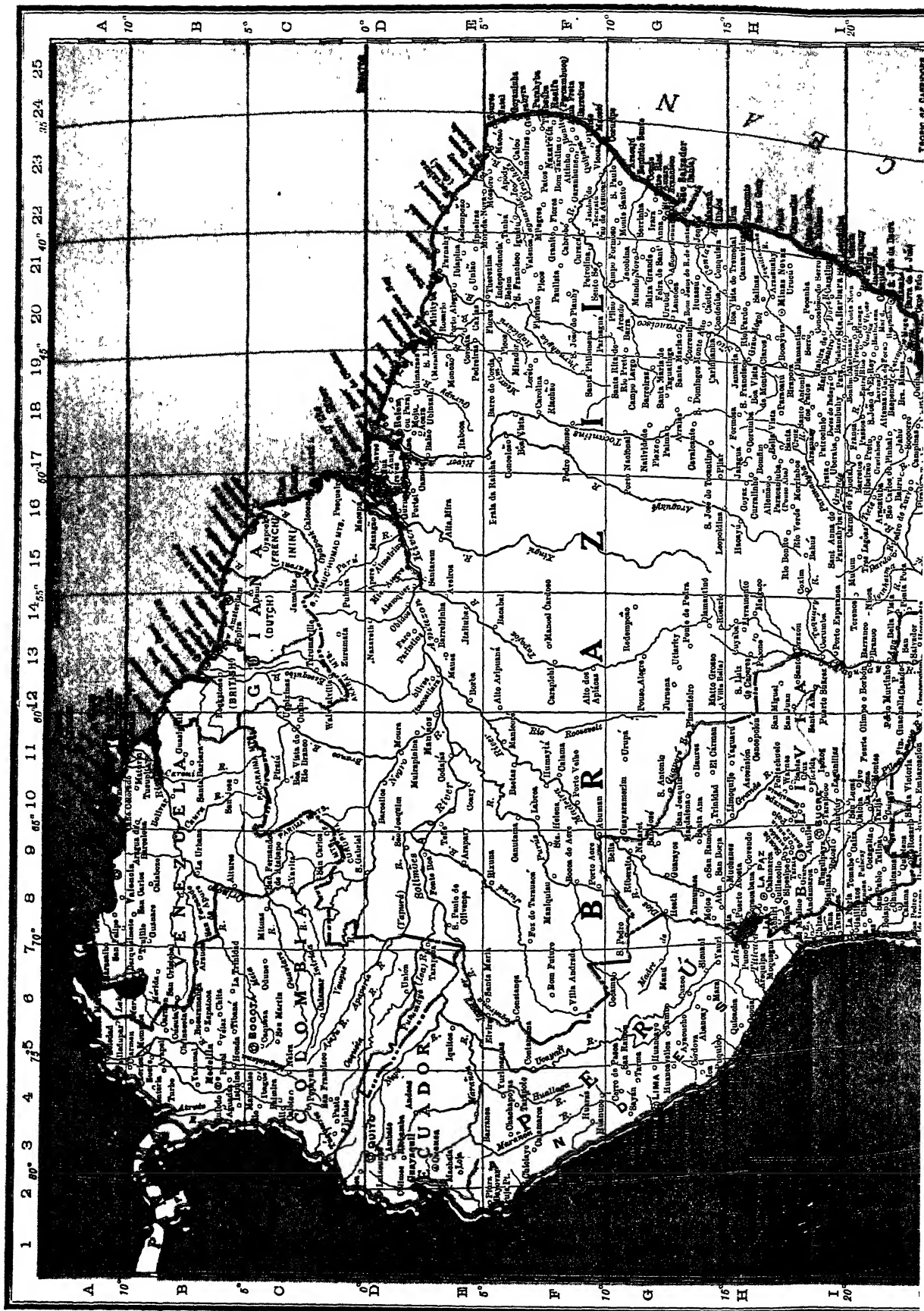
are found chiefly in Paraguay and Bolivia. Negroes and Mulattoes are numerous in Brazil where slaves were introduced from Africa. The Catholic religion prevails throughout.

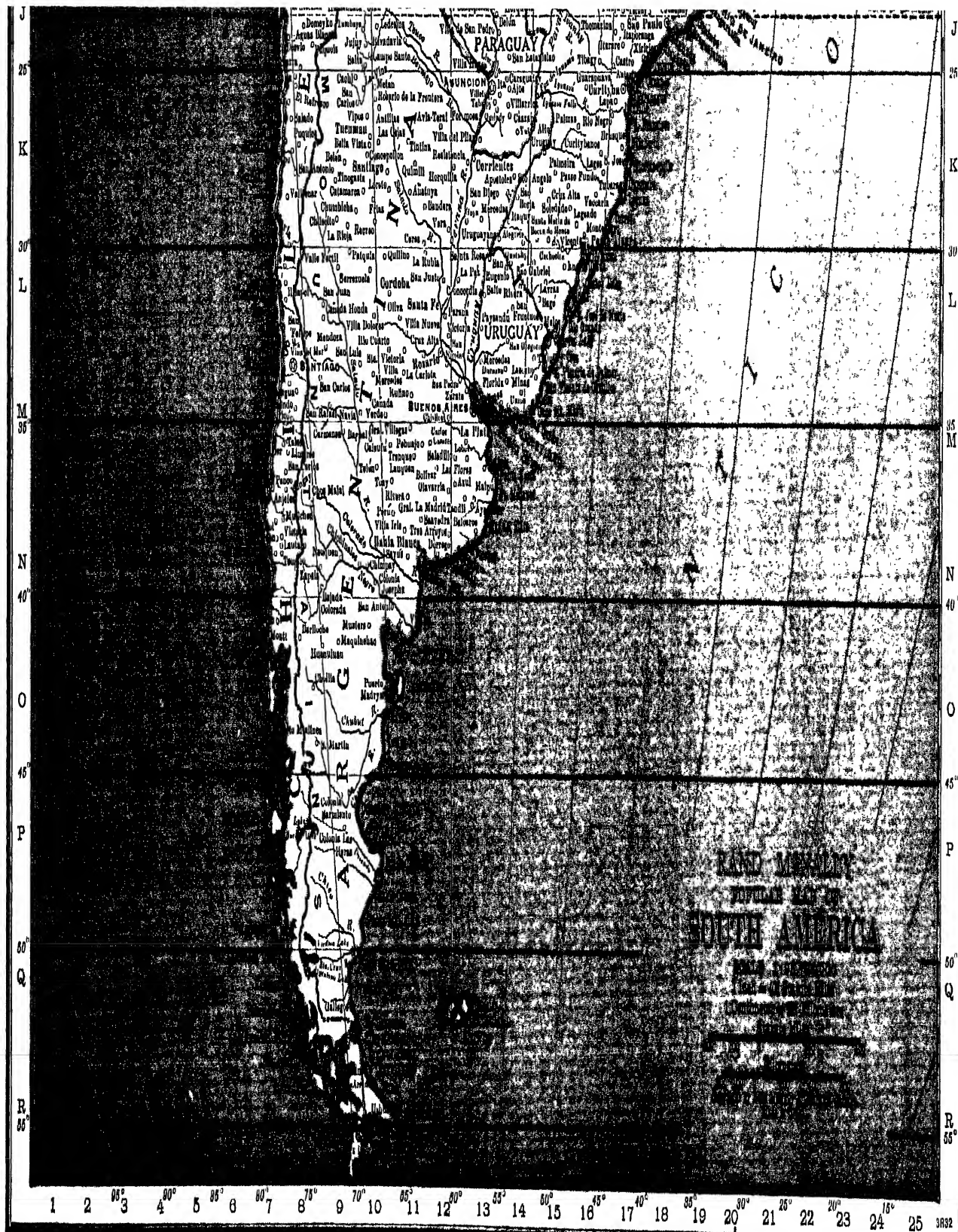
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SOUTH AMERICAN AND ANTILLEAN INDIANS, LANGUAGES OF, a geographical rather than linguistic term for the the aboriginal languages spoken in South America and the Antilles.

Although many individual dialects of the Indians have been studied, too little is known of the languages as a whole to admit of more than a superficial classification, though the number of linguistic stocks, most of which have several languages and dialects, is provisionally given as 77: Alakaluf, Alentiak (extinct), Amuesha, Araucan, Arawak, Arda, Atakama, Atalan (these three extinct), Auaké (almost extinct), Aymará, Bororó, Carib (both in the Antilles and on the north-eastern part of the continent), Chapakura, Charrúa (extinct), Chibcha, Chikito, Chirino (extinct), Choko, Cholona, Chon, Diagit (extinct), Enimaga (almost extinct), Esmeralda (extinct), Guahibo, Guarauno, Guató, Guaykurú, Het (extinct), Huari, Itonama, Kahuapana, Kaliána, Kañari (extinct), Kanichana, Karajá, Karirí, Katukina, Kayuvana, Koche (almost extinct), Kófane (extinct), Leko, Maku, Maskoi, Mashubi, Matakó-Mataguayó, Mobima, Moseten, Múra, Nambikuára, Otomak, Pano, Puelche, Puinave, Purúha (extinct), Quichua, Saliba, Samuku, Sanaviron (extinct), Sek, Shavanté, Shirianá, Timote, Trumai, Tukáno, Tupi-Guaraní, Tuyuneiri, Vilela-Chulupí, Witóto, Xíbaro, Xiraxara, Yahgan, Yaruro, Yunka (extinct), Yurakáre, Yuri, Záparo, and Zhé, the chief groups being Araucan, Arawak, Aymará, Carib, Chibcha, Guaykurú, Pano, Quichua, Tupi-Guaraní, and Zhé.

Of all these, only Quichua has ever approached the dignity of a language of civilization or has developed a literature, first under the direct propagation of the conquering Incas and then under that of the Spanish missionaries. The most wide-spread stock is the Arawak, which extends from the Antilles to northern Paraguay, and from the Peruvian coast to the mouth of the Amazon. In the Lesser Antilles, however, shortly before the coming of the Spaniards, the Arawak had been conquered by Carib from Guiana, an event which resulted in the very interesting linguistic phenomenon of a "women's language" as distinct from the "men's language." The Arawak men were massacred by the Carib, and the women became the wives of the victors, but retained their own language. Consequently, the women and children spoke Arawak, but the men Carib, a custom





still observed among the Carib of Dominica and, in vestiges, even among those of Honduras. L. H. G.

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SOUTHAMPTON, a seaport of England, in the county of Hampshire, on a peninsula at the mouth of the Itchen, near the head of Southampton Water, 78 mi. southwest of London.

Favored by a sheltered position, by deep waters that are nearly silt-free and by double tides, the largest vessels can here approach open quay sides and come and go almost at will. The natural channel, already roomy, is being continually improved and widened, and the triangular dock area gives a maximum of water frontage with minimum transshipment distances. Behind this the town, mounting gentle slopes, fills and overflows the larger triangle which lies between the rivers Test and Itchen. The situation of the port, neither too far seaward nor landward of the boundary line between northwest Europe and the Atlantic, is a potent factor in its supremacy. With 34% of the total United Kingdom ocean passenger traffic and a very large mail and troop service, Southampton stands easily at the head of the passenger ports of Britain. Its connections are world wide; 44% of its traffic is with other parts of the British Empire, and during the summer there is an average of one large vessel sailing every day to New York. In 1930 Southampton ranked third to London and Liverpool in value of cargo trade. The manufactures are chiefly confined to shipbuilding, brewing and iron-casting. Pop. 1921, 160,994; 1931, 176,425.

SOUTHAMPTON, a village of southeastern New York, in Suffolk Co. It is situated about 90 mi. east of New York City on the south shore of Long Island, facing the Atlantic Ocean. The Long Island Railroad and buses afford transportation. Potatoes and garden truck are grown in the region. Southampton is a famous and fashionable summer resort, with many estates and clubs in the vicinity. It was settled in 1640, and became an important whaling center during the two centuries following. Southampton was incorporated as a village in 1894. Pop. 1920, 2,891; 1930, 3,737.

SOUTH AUSTRALIA, a state of the Commonwealth of Australia, situated between 26° and 37° S. lat. and 129° and 141° E. long., the total area being 380,070 sq. mi. The Northern Territory, annexed in 1863, continued a part of South Australia until it was constituted a separate division in 1911. The state's population in 1921 was 495,160; in 1930 it was estimated at 580,619. ADELAIDE is the capital and the only city of important size. South Australia was first colonized in 1836 and became a Crown colony in 1841.

Mountain ranges are scattered over the eastern part of the state, the highest peak being about 3,000 ft. in height; much of the western and nearly all the northern portion of the state are desert lands, almost useless for cultivation. There is no possibility of irrigating this area, as the available water in South

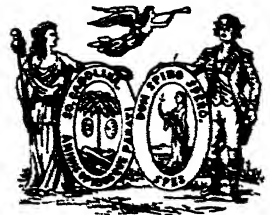
Australia's only river, the Murray, cannot supply more than 1,000,000 acres. The fertile land that surrounds the hill country of the east produces a large quantity of wheat, oats and barley. The cultivation of oranges, apples, apricots, peaches and olives is also successful. About 15,000,000 gallons of wine are produced yearly. The principal exports are wheat and flour, dressed meat, skins and hides, butter, minerals, especially copper, wines and fruit.

SOUTH BEND, a city in northern Indiana, the county seat of St. Joseph Co. It is situated on the St. Joseph River, 86 mi. southeast of Chicago and is served by airplanes, bus and truck lines and five steam lines and two electric lines. The river affords hydroelectric power. The principal manufactures include automobiles, farm wagons, agricultural implements, automobile and airplane accessories, paints and varnishes and men's clothing. In 1929 the total factory output was worth about \$163,000,000; the wholesale trade proper amounted to \$29,360,346 and the retail, to \$69,241,332. One hundred and nine artesian wells furnish the city's water. South Bend is the seat of the University of Notre Dame and St. Mary's College. In 1820 the American Fur Company occupied the site as a trading post. The city was chartered in 1865. Pop. 1920, 70,983; 1930, 104,193.

SOUTHBRIDGE, a town in Worcester Co., southern Massachusetts, situated on the Quinebaug River, 22 mi. southwest of Worcester. It is served by the New Haven Railroad. Abundant hydroelectric power is derived from the 22-ft. fall in the Quinebaug at this point. The chief manufactures are woolen goods, cutlery, and optical merchandise. Southbridge is the center of the optical goods industry in the United States. The factory output is annually valued at about \$17,225,147. The retail business in 1929 amounted to \$5,358,653. A poll parish, known as Honest Town, was organized from sections of Sturbridge, Dudley and Charlton. In 1816 this became the incorporated town of Southbridge. Pop. 1920, 14,245; 1930, 14,264.

SOUTH BROWNSVILLE, a borough of Fayette Co., in southwestern Pennsylvania, situated on the Monongahela River, about 30 mi. southwest of Pittsburgh; it is served by the Pennsylvania Railroad. South Brownsville, and the neighboring boroughs of Brownsville and West Brownsville are practically one industrial community. The vicinity has coal mines and gas and oil fields. Pop. 1920, 4,675; 1930, 5,314.

SOUTH CAROLINA, a south Atlantic state, one of the original thirteen states of the United States, popularly called the "Palmetto State." It is situated between 32° 2' and 35° 17' N. lat. and 78° 30' and 83° 20' W. long. On the north it is bounded by North Carolina, on the east by North Carolina



SOUTH CAROLINA STATE SEAL

and the Atlantic Ocean, on the southeast by the Atlantic Ocean, and on the southwest and west by Georgia from which it is separated by the Savannah, Tugaloo and Chattooga rivers. South Carolina comprises an area of 30,989 sq. mi., inclusive of 494 sq. mi. of water surface. It is somewhat triangular in shape and in size ranks 39th among the states.

Surface Features. South Carolina is made up of sections of the Piedmont Plateau and Atlantic Coastal Plain except for the extreme northwestern corner which is crossed by the Unaka Mountains. This outlying range of the Blue Ridge contains such peaks as Mt. Pinnacle, 3,413 ft. high, Caesars Head, 3,218 ft., and Sassafras Mountain, 3,548 ft., in Pickens Co., the highest point in the state. Its mean elevation above sea level is 350 ft.

The Piedmont region is a rolling tableland which slopes toward the sea and is crossed by the trench-like valleys of the Peedee, Lynches, Wateree and Broad rivers. These streams are important sources of water power, especially where they cross the edge of the plateau or fall line.

The Atlantic Coastal Plain in South Carolina is wide, low and level, and an important cotton-growing section except near the sea where salt marshes and swamps exist. It has 281 mi. of coast line indented by several harbors of which Charleston is the most important. Toward the south the coast becomes intricately cut and has numerous off-shore islands.

Climate. Because of its situation largely within the coastal plain with only a small and low mountain area at the northwest, South Carolina has a mild and comparatively uniform climate. The mean annual temperature for the state is 62.9° F., varying from 66° F., with an average of 49.9° F. for January and 81.4° F. for July, at Charleston situated on the coast to 59.1° F., with an average of 40.3° F. for January and 76.9° F. for July, at Greenville in the mountainous district. During the period, 1887-1930, the highest temperature recorded in South Carolina was 111° F. and the lowest -11° F. The average annual precipitation is 48.1 in., ranging from 45.2 in. at Charleston to 53.2 in. at Greenville. At Charleston the growing season is about 293 days; at Greenville, 213 days.

Forests and Parks. Approximately 17,920,000 acres of the total land area were originally forested, and the state was famous for its magnificent stands of long-leaf pine. As estimated in 1931 all but 500,000 acres of the original forest cover has been removed and second-growth forests cover 12,300,000 acres. The coastal plain or the low country varies from palmettos on the islands and cypress and evergreen oaks with long festoons of hanging moss to extensive pinelands formerly covered with long-leaf but now characterized by short-leaf and loblolly pines, oaks, hickories, beech, birch, ash, maple, black walnut and chestnut. Scattered growths of long-leaf pine are springing up in the Sand Hill region. The long-leaf pine of the Piedmont Plateau or up country has been entirely cut over and the present trees

are short-leaf pine and hardwoods. In the mountains the characteristic trees are white pine, short-leaf pine, hemlock and laurel. South Carolina has neither state-owned forests nor parks. Forty game sanctuaries of approximately 100,000 acres in 500 to 5,000 acre areas have been set aside as regions where game may breed unmolested. A 43,490 acre portion of the Nantahala National Forest extends into the extreme western part of the state. CASTLE PINCKNEY, a National Monument, is at Charleston.

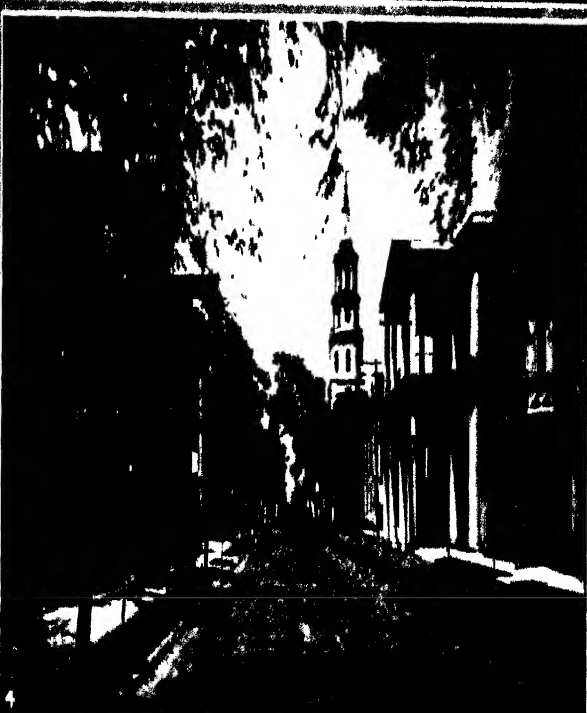
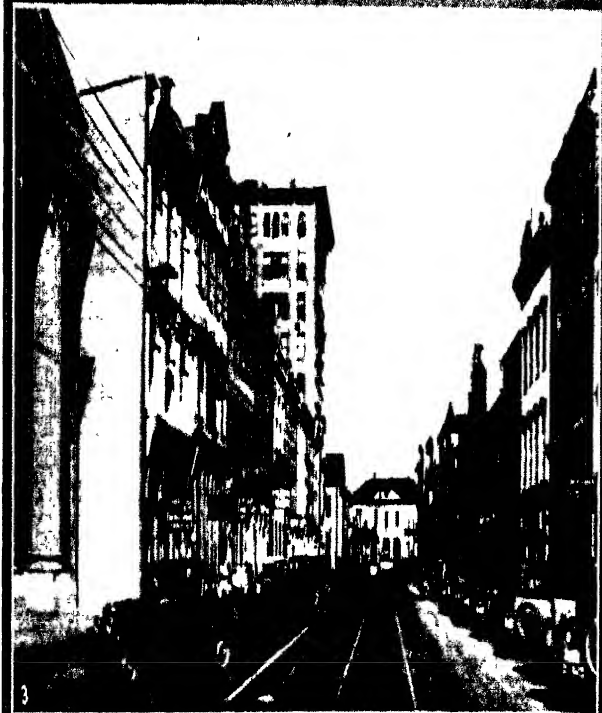
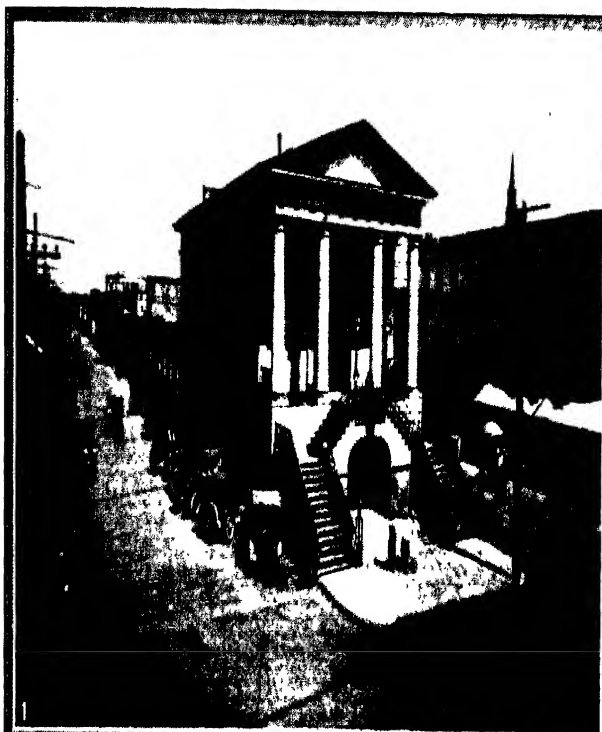
Minerals and Mining. The mineral resources of South Carolina are of minor importance, and its output consists mainly of building stone and clay products. With mineral productions in 1929 amounting to \$3,592,112, South Carolina stood forty-fourth among the states. Of chief importance were granite valued at \$1,748,081; clay products, \$1,252,817; and sand and gravel, 1,068,005 tons, \$602,432. During 1929 35 mines and quarries gave employment to 1,423 persons who received \$1,227,584 in salaries and wages.

Soil. On the Coastal Plain the soil is a fertile tenacious sand which becomes looser and less rich inland from the coast. The soils of the Piedmont Plateau consist mainly of red clays, more or less intermixed with sand, formed through the disintegration of the underlying granitic and gneissic rocks. In the north central part of the state areas of dark clay soils, resulting from the weathering of traprock, and sections of sand and gravel soil are common.

Agriculture. The chief crops produced are cotton, corn, vegetables, and tobacco.

In 1930 10,393,113 ac. or 53.3% of the entire land area was in farms, 157,931 in number, with an average size per farm of 65.8 ac. and an average value per acre of \$36.48. Of the farm area 5,036,998 ac. or 48% was crop land; 1,792,997 ac. or 17%, pasture land; and 2,850,684 ac. or 27% woodland. The total value of farm property was \$439,680,329, of which \$379,190,630 was represented by land and buildings; \$21,424,986, by implements and machinery; and \$39,064,713, by domestic animals.

According to the census of 1930 South Carolina produced in 1929 field crops to the value of \$139,458,484, ranking twenty-eighth among the states. It stood fifth in tobacco, seventh in cotton and eighth in cottonseed; in vegetable production it ranked third in asparagus, fifth in watermelons and seventh in sweet potatoes. The chief crop was cotton, 835,963 bales grown on 1,973,228 ac. and valued at \$68,548,966, together with cottonseed, 381,260 tons, \$10,675,280. Other important crops were grain, \$23,557,069, chiefly corn 19,325,815 bu. and oats 2,229,914 bu.; vegetables, \$17,211,104; tobacco, 83,302,706 lbs. grown on 112,852 ac. and valued at \$13,328,433; hay and forage, 149,765 tons, \$3,469,982, and fruits, \$1,766,880, mostly peaches 689,650 bu. The leading vegetables included sweet potatoes \$4,259,434, potatoes \$3,612,347, asparagus \$701,791, beans \$627,931, and watermelons \$603,292. The state produced 539,406 gals. of sugar cane sirup and 272,319 gals. of sweet sorghum.



3 AND 4, CHARLESTON CHAMBER OF COMMERCE; 2, COLUMBIA CHAMBER OF COMMERCE

THE CAPITOL OF SOUTH CAROLINA AND VIEWS OF CHARLESTON

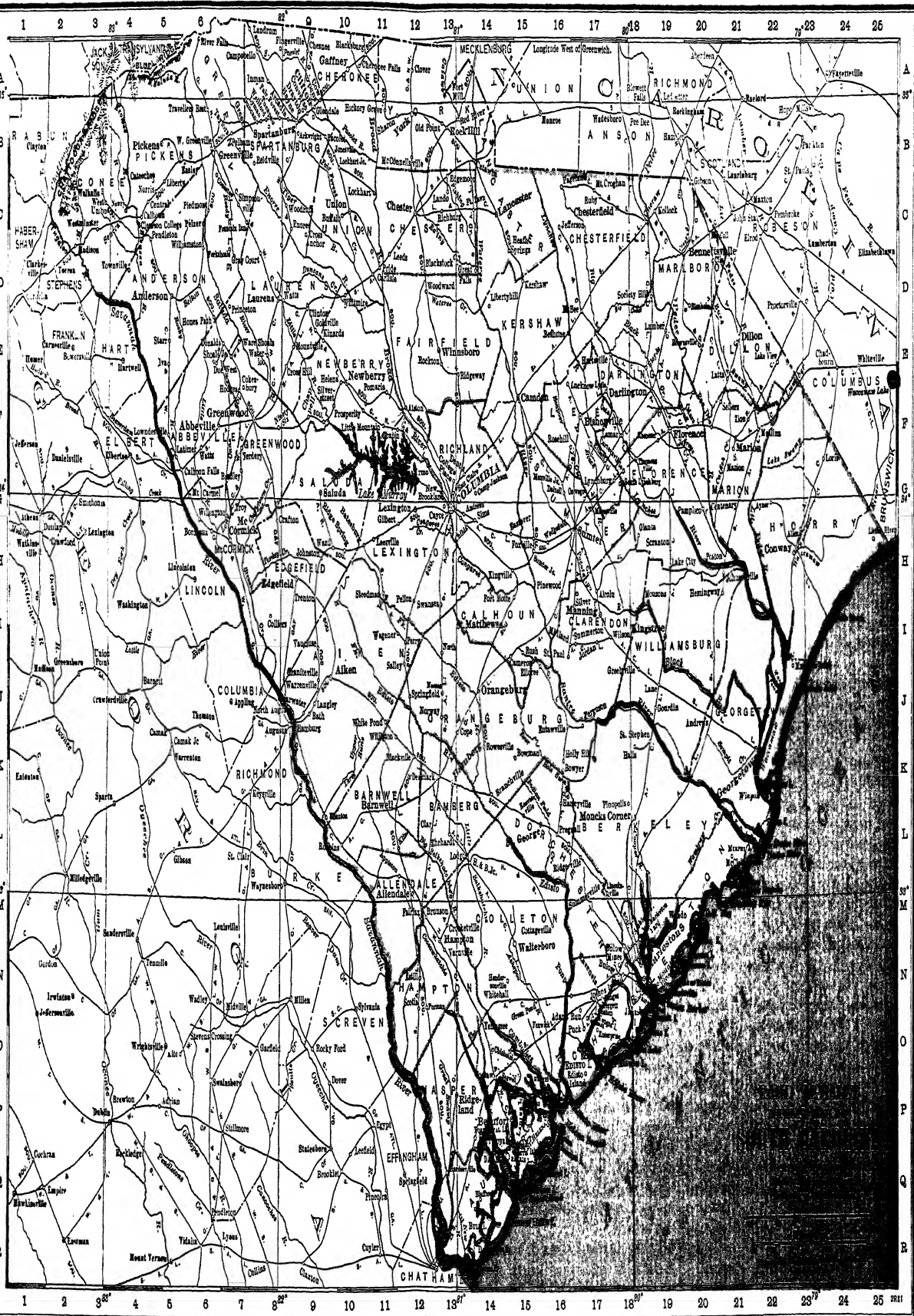
1. The Old City Market at Charleston, now used as a Confederate museum. 2. The State Capitol at Columbia, built of South Carolina granite. 3. Charleston's financial center, looking east on Broad Street. 4. Charleston, Meeting Street. In the background is the historic St. Michael's Church.

SOUTH CAROLINA

Area 50,599 sq. m.
Pop. 1,735,765

PRINCIPAL CITIES

- Pop. Thousands
- 4 Abbeville... P 6
 - 6 Aiken... J 9
 - 2 Allendale... M 11
 - 14 Anderson... D 5
 - 2 Anderson... J 20
 - 1 Arden... G 16
 - 2 Bamberg... K 13
 - 2 Barrow... L 11
 - 3 Batesburg... G 11
 - 3 Beaufort... P 14
 - 2 Belton... D 6
 - 4 Bennettsville... C 20
 - 2 Bishopville... F 17
 - 2 Blackburg... A 10
 - 1 Blackville... K 11
 - 2 Branchville... K 15
 - 2 Buffalo... C 10
 - 2 Calhoun Falls... G 6
 - 3 Camden... F 15
 - 1 Cayce... G 13
 - 1 Centerville... C 5
 - 62 Charleston... N 19
 - 4 Cheraw... C 19
 - 6 Chester... C 11
 - 6 Clifton... A 9
 - 6 Clinton... D 9
 - 3 Clover... A 12
 - 2 Columbia... G 14
 - 50 Columbia... G 14
 - 1 Converse... A 9
 - 3 Conway... H 22
 - 1 Coppen... A 9
 - 6 Darlington... F 18
 - 2 Denmark... K 12
 - 3 Dillon... E 21
 - 3 Easley... B 6
 - 3 Elm Grove... G 12
 - 2 Edgefield... H 8
 - 1 Ellenton... J 15
 - 2 Enore... C 9
 - 1 Estill... N 12
 - 1 Fairfax... M 12
 - 15 Florence... P 20
 - 2 Fort Mill... A 13
 - 7 Gaffney... A 10
 - 3 Georgetown... K 21
 - 3 Graniteville... J 9
 - 4 Great Falls... D 14
 - 29 Greenville... B 7
 - 11 Greenwood... F 7
 - 2 Greer... B 7
 - 3 Hartsville... F 17
 - 3 House Park... B 6
 - 1 Inman... A 8
 - 1 Iva... E 5
 - 1 Johnston... H 9
 - 1 Jonesville... B 10
 - 1 Kershaw... D 15
 - 2 Kingstree... I 18
 - 2 Lake City... H 19
 - 1 Lancaster... C 13
 - 1 Landrum... A 8
 - 1 Latta... E 20
 - 5 Laurens... D 8
 - 1 Leesville... H 11
 - 1 Lexington... G 11
 - 2 Liberty... C 5
 - 2 Lockhart... C 10
 - 2 McCall... C 20
 - 3 McComb... G 7
 - 1 Manning... I 17
 - 3 Marion... P 21
 - 3 Mullins... P 22
 - 7 Newberry... E 10
 - 2 New Brookland (Brookland)... G 12
 - 2 N. Augusta... J 8
 - 9 Orangeburg... J 14
 - 7 Palmetto... C 6
 - 4 Piedmont... C 6
 - 11 Rock Hill... B 13
 - 2 St. George... L 15
 - 2 St. Matthews... I 14
 - 3 Seneca... C 4
 - 29 Spartanburg... B 8
 - 3 Summerville... M 17
 - 12 Sumter... H 17
 - 2 Timmonsville... G 18
 - 7 Union... C 10
 - 2 Walhalla... C 3
 - 2 Walterboro... N 15
 - 2 Ware Shoals... F 7
 - 2 W. Greenville... B 6
 - 2 Westminster... C 3
 - 3 Whitmire... D 10
 - 2 Williamsport... C 6
 - 2 Windsor... E 13
 - 3 Woodruff... C 9
 - 3 York... B 12



Farm products sold by cooperative marketing rose from \$961,999 in 1919 to \$3,855,277 in 1929. Farm machinery and equipment in 1930 included 61,754 automobiles, 6,966 motor trucks, 3,462 tractors, 945 electric motors, and 2,677 stationary gas engines.

Animal Industry. Mule-raising and cattle-raising, chiefly for milk production, are the principal livestock interests. According to the census of 1930, South Carolina ranked thirty-eighth among the states in total value, \$39,064,713, of domestic animals on farms. Among these were mules, 188,895, valued at \$19,210,143; horses, 30,497, \$2,184,886; cattle, 270,171, \$11,077,922; swine, 471,104, \$3,913,110, and sheep, 18,841, \$101,091.

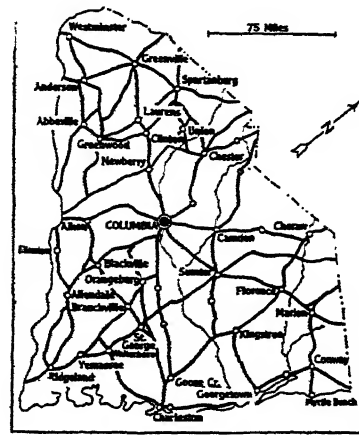
Of the cows on farms, 150,658 were kept mainly for milk production and 16,587 mainly for beef production. In 1929, 52,525,520 gals. of milk were produced; the total value of dairy products sold was \$4,218,731, including \$2,917,150 for whole milk marketed. The value of all poultry raised, chiefly chickens, was \$6,043,307; the chickens sold were valued at \$1,863,588. Of 15,907,485 doz. chicken eggs produced, valued at \$5,178,124, 6,744,571 doz., with a value of \$2,194,525, were marketed. Honey, amounting to 513,260 lbs. valued at \$106,140, was produced from 46,448 hives.

Fisheries. There is little commercial fishing, the 1930 catch amounting to but 6,135,000 lbs., valued at \$275,000. The most valuable species taken are shad, alewives, butterfish, scup, oysters and crabs. There is little game fishing. The state issued 1,084 fishing licenses in 1930, but did no fish propagation work. The U.S. Bureau of Fisheries planted 400,000 bass and other game fish in state waters during 1930.

Transportation. In point of performance, the Charleston and Hamburg line is entitled to precedence in the list of railroads operated by steam in the United States. Chartered in 1827, by Jan. 1, 1830 six miles of road were ready for the "Best Friend," the first practical locomotive built in America. By 1834 the road had 137 mi. in operation, and for a short time it was the longest railroad in the world under one management. In 1930 the aggregate steam railway mileage of South Carolina was 3,779, with the Southern, the Atlantic Coast Line, and the Seaboard Air Line the most important systems. Transportation by water to foreign and coast ports is afforded by the port of Charleston. The Savannah River, forming the southwestern boundary of the state, is navigable for about 200 mi., and connects Savannah with Augusta, Ga.

The state highway system is well maintained. On Jan. 1, 1930 there were 75,254 mi. of highways in the state, including 17,576 mi. of surfaced roads and 4,891 mi. of improved state highways. During 1929, highway expenditures were \$24,424,658, of which \$15,372,739 was paid by the state and \$9,051,919 by county and local governments. Gasoline consumption in 1930 aggregated 119,213,000 gals. The state gasoline tax that year produced an income of \$7,145,711 as against \$4,496,968 in 1926. Motor ve-

hicle registrations were 218,402 in 1930 compared with 168,496 in 1925. The rapid growth of transportation by truck is indicated by registrations, which rose from 15,153 in 1925 to 26,261 in 1930, or nearly 75%. During the same period the number of buses



SOUTH CAROLINA STATE ROADS

in operation increased from 405 to 1,394, or over 240%.

Manufactures. South Carolina since 1900 has become a leading producer of cotton goods, ranking second only to North Carolina. This expansion in the textile industry has been due in the main to the development of cheap hydro-electric power along the "fall line" in the Piedmont region, abundant supplies of raw material, inexpensive labor and good transportation.

According to the Census of 1930 South Carolina with manufactures for 1929 valued at \$385,892,252 stood thirty-second among the states. Its 1,659 establishments gave employment to 5,099 officers and employees, who received \$12,800,005 in salaries, and to 108,777 wage earners, who were paid \$73,223,327 in wages. These factories used a total of 527,326 horse power, expended \$12,335,642 for fuel and power and \$214,205,961 for materials and supplies, and added by the process of manufacture \$159,350,649 to the value of their output.

In this output there were 36 separately enumerated industries. The outstanding product was cotton goods, valued at \$241,435,659, constituting 62% of the total manufactures of the state. Among other manufactures, with value of output, were lumber, \$27,935,772; fertilizers, \$14,050,480; cottonseed oil, \$11,405,489; planing mill products, \$8,610,216; dyeing and finishing textiles, \$8,555,189, and printing and publishing, \$5,488,450.

Cotton goods manufacture is confined mostly to the northwestern counties. The chief manufacturing cities with value of output were Charleston, \$19,765,055; Columbia, \$18,107,816, and Greenville, \$11,139,428.

Commerce. According to the census of 1930, there were in 1929 1,539 wholesaling establishments in

South Carolina with total sales of \$333,528,360. These organizations gave full-time employment to 7,726 men and women whose annual salaries and wages aggregated \$10,534,517. The chief wholesaling center is Greenville.

The total sales of the 15,082 retail stores amounted to \$299,037,807. Sales per store averaged \$19,827; sales per capita were \$171.98.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
General Mdse.	2,882	\$87,462,558	29.25
Food	5,649	63,816,960	21.33
Automotive	2,616	62,318,885	20.84
Apparel	539	15,342,231	5.13
Lumber & Bldg.	341	14,307,851	4.79
Furn. & Household ..	387	13,830,610	4.62
All other stores .. .	2,668	41,948,712	14.04
Total, all stores ...	15,082	\$299,037,807	100.00

Charleston, the principal port, handled water-borne commerce amounting to 2,680,934 tons, with a value of \$180,545,167. Logs and lumber, gasoline and oil, sodium nitrate and coal were the largest items.

Finance and Banking. The assessed value of all taxable property in 1929 was \$426,359,133. The total bonded debt in 1930 was \$25,171,060, less sinking funds of \$746,822. Total state revenues in 1929 were \$21,653,726; total disbursements, \$27,176,320. The chief sources of income were property taxes, \$5,455,810 and licenses, \$12,760,100. This item included taxes on corporations and insurance companies; soft drinks, motor vehicles and gasoline, \$5,227,064. The principal payments included highway expenditures, \$13,558,431, educational aid, \$4,119,874, and debt service, \$1,456,734.

There were 229 banks in South Carolina in 1930. Of these, 53 were national banks, 195 trust companies and state banks and 1 private bank. Their total capitalization was \$22,048,087; their surplus and undivided profits, \$11,954,000. Total resources were \$205,324,000, with loans and discounts aggregating \$116,751,000. Demand and time deposits totaled \$156,368,000. Per capita demand and time deposits were \$89.97; per capita savings deposits, \$43.35. The total savings of \$75,336,000 were owned by 195,645 depositors. National bank circulation aggregated \$3,406,000.

Government. The legislative body of South Carolina, known as the General Assembly, consists of a Senate, composed of 46 members and a House of Representatives of 124 members, the former elected for terms of four years and the latter for terms of two years. They meet in annual sessions unlimited in duration. The chief executive is the governor, elected for terms of two years at a salary of \$5,000 per year. Other executive officers are the lieutenant governor, secretary of state, comptroller general, state superintendent of education, commissioner of agriculture, commerce and industries, adjutant and inspector general, treasurer, and attorney-general. Judicial power is vested in a supreme court, 2 circuit courts which

comprise a court of common pleas, and a court of general sessions. The supreme court consists of 5 judges chosen by the legislature for terms of ten years at salaries of \$4,500 per annum.

Social Welfare Institutions. There is an industrial school for boys at Florence and one for girls at Columbia, and a reformatory for colored boys near that city. At Clinton is a training school for mental defectives. A Confederate home, state hospital and penitentiary are at Columbia. The state has two farms at Boykin. The Catawba Indian Reservation is 11 mi. from Rock Hill.

Education. The first school was established in Charleston in 1701, and was taught by John Douglas. Ten years later a free school was opened there. Little was done toward the advancement of education in the next century, but by 1826, 32 academies had been founded. In 1870, legislation was passed which established an adequate school system. Separate schools are maintained for Negroes. Compulsory education laws require children from 8 to 14 years (8 to 16 if unemployed) to attend school 4 months annually. In 1928, the 4,505 public schools had 394,717 pupils and 13,138 teachers, and the 224 public high schools had 46,958 pupils and 1,324 teachers.

The number of persons from 5 to 20 years of age attending school in 1930, was 429,150, or 60.1% of the population within the ages specified, as compared with 423,740, or 62.8%, in 1920. The number of persons 10 years and over unable to read and write in 1930 was 192,878, or 14.9%, as compared to 220,667, or 18.1%, in 1920. Negro illiterates numbered 156,065, or 26.9%, in 1930; and 181,422, or 29.3%, in 1920; native white illiterates numbered 36,246, or 5.1% of the population, in 1930, and 38,742, or 6.5%, in 1920.

Among the institutions of higher learning, the state maintains the University of South Carolina at Columbia, Clemson Agricultural College at Clemson, and Winthrop College for Women at Rock Hill. Other educational institutions include the municipal College of Charleston, Wofford College at Spartanburg, Furman University at Greenville, and, for Negroes, Benedict College at Columbia.

Population. In 1930 South Carolina ranked twenty-sixth among the states with a population of 1,738,765 or an average of 57.0% per sq. mi., an increase of 55,041 or 3.3% from 1920. The population rose from 249,073 in 1790 to 703,708 in 1860, 1,340,316 in 1900, 1,515,400 in 1910, and 1,683,724 in 1920. In 1930 there were 944,040 or 54.3% whites, 793,681 or 45.6% Negroes, and 954 or 0.1% Indians, an increase from 1920 of 15.3% whites and a decrease of 8.2% Negroes. Of the whites, 938,774 were native-born and 5,266 were foreign-born. The rural population was 1,367,685 or 78.7% of the total, a decrease of 22,052 or 1.6% from 1920; the urban population was 371,080 or 21.3% of the total, an increase of 77,093 or 26.2% since 1920. In 1930 the four largest cities were Charleston, 62,265; Columbia, 51,581; Greenville, 29,154; Spartanburg, 28,723.

Occupations. In 1930 687,737 persons, or 39.6% of the population, were gainful workers 10 years old or older; 69.9% of these were males and 30.1% were females; 49.5% were native white; 0.5% foreign-born white, and 49.9% Negro. Among the principal occupations, with number of workers, were farmers, 151,793, and farm wage workers, 82,358; factory operatives, 40,110 men and 28,475 women, including 32,086 men and 24,616 women in cotton mills; servants, 3,263 men and 30,647 women; factory laborers, 28,566 men and 1,560 women, including 11,596 men in saw and planing mills; laundresses, 19,012; school teachers, 1,965 men and 11,403 women; retail dealers, 13,313, and salespersons, 10,548 men and 3,501 women.

HISTORY

Jean Ribaut's attempt in 1562 to found a colony for Huguenots at Port Royal was antedated by a Spanish settlement on the South Carolina coast in 1526, but both ventures were abandoned after a few months. However, a Spanish settlement on Parris Island, founded in 1566, was maintained for nearly a generation. In 1663 Charles II granted the territory from sea to sea between parallels 31° and 36° to eight noblemen; in 1665 the limits were extended to 29° and 36° 31'. William Sayle with 200 colonists founded the first English settlement in 1670, beside the Ashley river; but the situation was unfavorable, and in 1680 most of the colonists moved to the site of Charleston. Circulars distributed in Europe offered attractive terms to emigrants. French Huguenots and English from Barbados were among the 5,500 people in the colony by 1700. The Fundamental Constitutions, devised by Lord Ashley, one of the Lord Proprietors, and John Locke, his secretary, were rejected by the colony, which in 1693 secured the right of initiating legislation. Disputes over the collection of quit-rents were bitter. The Church of England was made the established religion in 1706. North and South Carolina were separated in 1710. Culture of rice and indigo steadily expanded during the 18th century, but the prosperity of the colony at first rested upon the Indian trade, in which the Carolinians daringly took the initiative, penetrating the wilderness, taking trade from the Spanish in Florida, and alarming the French in Louisiana. Charleston, the center of the Indian trade, became a cultural and commercial metropolis. The veto of several popular laws and refusal to aid in the YEMASSEE WAR cost the proprietors the colony. A popular convention assumed the government in 1719; in 1721 the crown sent Sir Francis Nicholson as royal governor, and later extinguished the rights of the proprietors by purchase. Royal government did not check the rising tide of democracy; the popular assembly continued to outweigh both the governor and council. The colony figured in Revolutionary agitation, voted troops as early as June, 1775, forced the governor to flee in September, and established a state government six months later. However, a numerous Loyalist element

and the presence of British troops in 1780-1782 caused the state to suffer severely.

Differences between the frontier regions and the wealthier eastern section did not prevent ratification of the Federal Constitution May 23, 1788, but were reflected in the adoption of a new state constitution in 1790 which made the legislature practically supreme. In 1808 a revision, which lasted until 1868, was made whereby representation was equally divided between population and wealth. Columbia succeeded Charleston as the capital in 1790. The westward extension of the cotton plantations system overwhelmed early opposition to slavery interests. As an opponent of protectionism in tariff (*see* NULLIFICATION, RIGHT OF; TARIFF ACTS, UNITED STATES, 1828, 1832, 1833), then as a rabid champion of slavery (*see* CALHOUN, JOHN C.), the state took the lead in secession (*see* CONFEDERATE STATES), and its troops precipitated the Civil War (*see* FORT SUMTER). The state put 62,838 troops in the field; it suffered heavily from the ravages of war, especially from General Sherman's march to the sea in 1865. The RECONSTRUCTION ERA was particularly corrupt in South Carolina. The state has since been an immovable element of the SOLID SOUTH, committed to the Democratic party as an agency of "white supremacy," as well as for historical reasons. As in the *ante-bellum* period when Charleston was the center of an aristocracy of rice-planters and merchants, political division between the seaboard and the region above the fall line has been evident. Staunchly Democratic as always, South Carolina in 1928 gave its electoral votes to Alfred E. Smith, in 1932 to Franklin D. Roosevelt. In the latter year, Ellison D. Smith, Democrat, was reelected to the United States Senate.

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SOUTH CAROLINA, UNIVERSITY OF, at Columbia, S.C., a coeducational state institution, chartered in 1801. During the Civil War the institution was used by the Confederate Government as a hospital. Reopened in 1866, it was again closed in 1877 because of political unrest in the state. Later it was reopened as two institutions, the South Carolina College at Columbia, and Claflin College at Orangeburg, the latter for Negroes. After undergoing various changes, in 1906 the institution at Columbia became the University of South Carolina. It comprises a College of Arts and Science, Graduate School, schools of Education, Commerce, Journalism, Engineering, Pharmacy and Law, a Summer School and an Extension Division. The productive funds in 1931 amounted to \$375,000. The library contained 110,000 volumes. In 1931-32 there was a student enrollment of 1,655, and a faculty of 98 headed by Pres. DAVISON McDOWELL DOUGLAS.

SOUTH CHINA SEA, a part of the Pacific Ocean, bounded on the north by China and Formosa, on the west by the Malay Peninsula, Siam and Indo-

China, on the south and east by the Philippines and Borneo. In the southern part the sea averages about 1,000 ft. in depth but in the north it reaches more than 13,000 ft. At times navigation is rendered dangerous by typhoons of great fury. The main rivers which drain into the China Sea are the Si-Kiang, the Mekong and the Menam. Aside from Hainan the China Sea contains no large islands. Manila, Hongkong and Singapore are among the important ports situated in the China Sea.

SOUTH DAKOTA, one of the North Central States of the United States, popularly called the "Coyote State." It is situated between $42^{\circ} 28'$ and $45^{\circ} 57'$ N. lat. and $96^{\circ} 26'$ and $104^{\circ} 3'$ W. long. The state is bounded on the north by North Dakota, on the east by Minnesota and Iowa, on the south by Nebraska and on the west by Wyoming and Montana. South Dakota comprises an area of 77,615 sq. mi., inclusive of 747 sq. mi. of water surface with a maximum length of 380 mi. from east to west and a maximum breadth of 245 mi. from north to



SOUTH DAKOTA STATE SEAL

south. In size South Dakota ranks fourteenth among the states of the Union.

Surface Features. Topographically, South Dakota is divided unequally between two major provinces. Less than one-third lies within the central lowlands of the United States, and two-thirds or more belong to the Missouri Plateau, a division of the Great Plains. It has considerable relief for a prairie state, the highest point being Harney peak, 7,242 ft. high, in Pennington Co., and the lowest 962 ft. on Big Stone Lake in Roberts Co. The mean elevation is 2,200 ft. above sea level.

The Missouri Plateau overlooks the central lowlands from the top of a sloping escarpment, 300 to 400 ft. high, which crosses the state from north to south a short distance west of the James River. Between this escarpment and the Missouri River is a remarkable morainic belt called the Missouri Coteau. Here the glacial drift is mixed with a large number of stones and piled in hummocks in a haphazard fashion as well as arranged in chains of hills 100 to 150 ft. high.

West of the Missouri River the plateau is cut by the broad, terraced valleys of the Grand Moreau, Cheyenne and White rivers, all tributaries of the Missouri. The interstream uplands are locally dissected into bad lands and weathered into buttes and mesas. Between the White and Cheyenne rivers in the southwestern part are the Big Bad Lands, an extensive area carved by wind and stream erosion into architectural features such as terraces, towers and battlemented cliffs. Between the Cheyenne and Belle Fourche rivers are the famous Black Hills, an isolated mountain dome rising about 4,000 ft. above

the plain. It is surrounded by the Red valley whose outer edge is a gray scarp of Dakota sandstone.

The eastern part of the state, belonging to the central lowlands, is locally called the Coteau des Prairies because of the prevalence of terminal moraines. It is dotted by numerous small shallow lakes.

Climate. Because of its interior position, the climate of South Dakota is continental with great extremes of cold in winter and heat in summer. The mean annual temperature for the state is 44.7° F. At Huron the average for January is 11.3° F. and for July 71.8° F. During the period 1890-1930, the highest temperature recorded in South Dakota was 115° F. and the lowest -57° F. The average annual precipitation is 20.8 in., including 36 in. of snow. At Huron the average date of the last killing frost in spring is May 10 and that of the first killing frost in autumn is September 23, giving an average growing season of 136 days.

Forests and Parks. The streams in eastern South Dakota are fringed with strips of deciduous forest which thin out toward the west until only scattered trees follow the stream courses. The principal trees in these forests are silver maple, box-elder, elm, white ash, hackberry and willow. The Black Hills in the southwest are partially forested with a combination of the deciduous trees found in the east and coniferous trees, chiefly western yellow pine and red cedar. Three national forests, Black Hills, Custer and Harney, with a total net area of 1,062,383 acres, have been set aside in this region. The Meade district of the Black Hills National Forest, 5,548 acres, is a national game refuge; JEWEL CAVE NATIONAL MONUMENT is in Harney forest. An 800-acre state game refuge containing birds, deer, elk, buffalo, mountain sheep and goats has been set aside in CUSTER STATE PARK, and in Harding Co. is a 10,000-acre state antelope preserve. WIND CAVE NATIONAL PARK and FOSSIL CYCAD NATIONAL MONUMENT are also located in the Black Hills region.

Minerals and Mining. Gold, obtained mostly from the Homestake mine at Lead in the Black Hills, comprises about three-fourths of the total mineral production of the state. In 1929, with a mineral output amounting to \$8,914,344, South Dakota stood thirty-eighth among the states, ranking second in the production of gold with a yield of 316,837 oz. valued at \$6,549,599. Among other products were stone valued at \$635,890, and sand and gravel, \$578,204.

Soil. In eastern South Dakota the prevailing soil is glacial drift, usually rich in vegetable mould and well adapted for the production of corn and wheat. Many of the river valleys contain highly fertile deposits of alluvium. In the western part of the state the soil is generally sandy or clayey and lacks vegetable mould. The plains adjacent to the Black Hills possess what is known as gumbo, a stiff soil suitable only for grazing lands. Occasionally throughout South Dakota alkaline deposits occur in small areas, some of which can be reclaimed for agriculture by proper drainage.

Agriculture. The chief agricultural interest is grain production, principally corn, oats, barley and wheat.

In 1930 36,470,083 ac. or 74.1% of the entire land area was in farms, 83,157 in number, with an average size per farm of 438.6 ac. and an average value per acre of \$35.24. Of the farm area 19,002,711 ac. or 52% was crop land, and 15,916,740 ac. or 44% pasture land. The total value of farm property was \$1,579,241,303, of which \$1,285,153,538 was represented by land and buildings; \$107,343,678, by implements and machinery; and \$186,744,087, by domestic animals.

According to the census of 1930 the state produced in 1929 field crops to the value of \$171,238,264, ranking twenty-fourth among the states. It stood third in barley and flax, fourth in rye, sixth in oats, eighth in wheat and ninth in corn. The leading crops were grains, valued at \$139,238,813, chiefly corn, grown on 3,493,279 ac., 84,569,812 bu.; oats, 2,271,899 ac., 62,480,531 bu.; barley, 2,061,136 ac., 35,652,875 bu., and wheat, 3,539,320 ac., 34,044,975 bu. Lesser grain crops included flax, 3,110,707 bu., and rye, 2,704,646 bu. Among other field crops were hay and forage, 2,645,277 tons, valued at \$24,146,482, largely wild grasses and alfalfa; vegetables, \$6,648,682, chiefly potatoes 4,169,943 bu.; sugar beets, 120,993 tons, \$839,691, and fruits, mostly apples, \$356,010.

Farm products sold by cooperative marketing fell from \$31,651,244 in 1919 to \$16,409,195 in 1929, and farm supplies purchased by this method, from \$3,583,771 to \$2,079,436. Farm machinery and equipment in 1930 included 81,923 automobiles, 14,816 motor trucks, 33,837 tractors, 4,686 electric motors and 34,475 stationary gas engines.

Irrigation. On the western border of the state irrigation has been developed in the drainage basins of various tributaries of the Cheyenne River. The irrigated area is practically confined to Butte, Custer, Fall River, Lawrence, Meade and Pennington counties. Butte Co. contains about two-thirds of the total irrigated acreage.

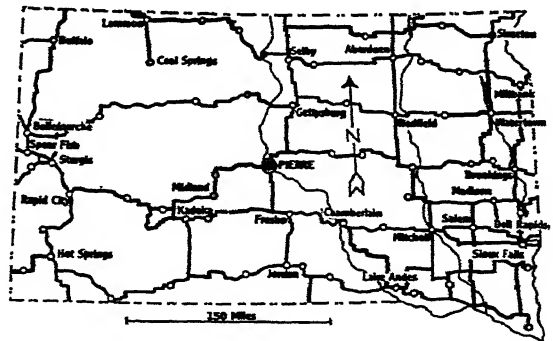
According to the Census of 1930 the total number of irrigated farms was 763, with an aggregate area of 379,270 ac., of which 67,107 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$10,520,455, or an average of \$27.74 per ac. The total investment in irrigation enterprises to 1930 was \$4,502,117, and the average cost of maintenance and operation for 1929 was \$1.33 per ac.

Animal Industry. Cattle-raising, both for milk and beef production, and hog-raising are the leading livestock interests. According to the census of 1930 South Dakota ranked twelfth among the states in total value, \$186,744,087, of domestic animals. Among these were 1,974,040 cattle reported from 73,961 farms or 89% of all farms in the state and valued at \$102,373,407; swine, 2,637,188 in number valued at \$35,146,747; horses, 621,343, \$31,779,921; mules, 19,168, \$1,189,150, and sheep, 1,150,346, \$9,423,140.

Of the cows on farms, 586,804 were kept mainly for milk production and 358,762 mainly for beef production. In 1929, 231,186,744 gals. of milk were produced; the total value of dairy products marketed was \$25,114,160, including \$22,061,842 for cream sold as butterfat. The value of all poultry raised was \$12,409,280. The number and value of the chief kinds were chickens, 14,658,577, \$10,621,645; turkeys, 460,106, \$1,266,745; ducks, 383,966, \$312,942, and geese, 144,329, \$207,948. The chickens sold, 5,864,365 in number, were valued at \$4,458,262. Of 53,052,330 doz. chicken eggs produced, valued at \$13,449,066, 36,786,186 doz., with a value of \$9,349,471, were marketed. The sheep industry yielded 6,564,273 lbs. of wool valued at \$1,862,053. Honey, amounting to 1,213,235 lbs. valued at \$152,506, was produced from 19,020 hives.

Fisheries. There is almost no commercial fishing in South Dakota, the total catch for 1930 amounting to but 767,000 lbs., valued at \$18,000. There is some game fishing, and during 1930, fishing licenses were issued to 112,209 sportsmen, who paid \$119,283 in fees. Six fish hatcheries were operated during 1930 at a cost of \$43,376, with an output of 1,367,765 trout, 43,550 bass, 5,275,967 other game fish and 96,735 commercial species. The U.S. Bureau of Fisheries has an egg-hatching station at Spearfish and in 1930 planted in state waters, 153,350 rainbow trout, 297,900 loch leven trout, 746,764 brook trout, and 45,000 other game fish.

Transportation. There are no navigable streams in South Dakota. In 1930 the state had a total steam railway mileage of 4,287, the greater part of which



SOUTH DAKOTA STATE ROADS

was controlled by the Chicago, Milwaukee and St. Paul and the Chicago and Northwestern systems. The Burlington, the Minneapolis and St. Louis, the Great Northern, the Rock Island and other lines also run through the state.

The state highway system is showing consistent development. Including the Yellowstone trail and the other principal through routes, there were 126,422 mi. of highways on Jan. 1, 1930, of which 6,147 mi. were surfaced roads and 3,618 mi. were improved state highways. During 1929, highway expenditures were \$12,903,555. Of this amount \$5,060,487 was

paid by the state and \$7,843,068 by county and local governments. Gasoline consumption aggregated 140,580,000 gals. in 1930. The state gasoline tax produced an income of \$3,503,882 that year as against \$1,924,758 in 1926. Motor vehicle registrations were 205,172 in 1930 compared with 168,028 in 1925. The rapid growth of transportation by truck is indicated by truck registrations, which rose from 13,887 in 1925 to 24,977 in 1930, or over 65%. During the same period the number of buses in operation nearly doubled, increasing from 188 to 357.

Manufactures. As the interests of the state are almost wholly agricultural, manufactures have been but slightly developed.

According to the Census of 1930 South Dakota with manufactures for 1929 valued at \$97,697,636 stood forty-third among the states. Its 615 establishments gave employment to 1,268 officers and employees, who received \$2,558,447 in salaries, and to 6,535 wage earners, who were paid \$8,132,240 in wages. These factories used a total of 31,297 horse power, expended \$1,471,106 for fuel and power, and \$73,545,318 for materials and supplies, and added by the process of manufacture \$22,681,212 to the value of their output.

In this output there were 20 separately enumerated groups of manufactures, the most important of which in order of value were meat packing, \$53,173,339; butter, \$17,981,061; bread, \$4,826,519; printing and publishing, \$4,321,337; poultry killing, \$2,229,118; steam railroad carshop construction and repairs, \$1,942,730; lumber, \$1,681,940, and flour, \$1,636,626.

Sioux Falls was the leading manufacturing center; its output, valued at \$47,170,805, amounted to 48% of the total for the state.

Commerce. According to the census of 1930, there were in 1929 1,974 wholesaling establishments in South Dakota, with total sales of \$236,490,607. These organizations gave full-time employment to 5,897 men and women whose annual salaries aggregated \$9,014,795. The chief wholesaling center was Sioux Falls.

The total sales of the 8,990 retail stores amounted to \$262,148,879. Sales per store averaged \$29,160; sales per capita were \$378.36.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive	2,011	\$68,935,103	26.28
General Mdse.	1,229	55,164,963	21.04
Food	1,443	34,676,318	13.22
Lumber & Bldg.	969	31,116,328	11.88
Apparel	504	11,811,927	4.51
Furn. & Household ..	294	6,722,463	2.57
All other stores	1,540	53,721,777	20.50
Total, all stores	8,990	\$262,148,879	100.00

Finance and Banking. The assessed value of all taxable property in 1929 was \$1,744,499,116. In 1928, the state had a direct bonded debt of \$15,425,000 and a rural credit debt of \$42,825,000. There were sinking funds of \$3,711,111. Total state revenues in 1929 were \$23,953,183; total disbursements, \$24,062,333. The chief sources of income were property,

gasoline, motor vehicle, corporation and insurance taxes. The principal payments were for highways, educational aid, debt service and permanent improvements.

There were 326 banks in South Dakota in 1930. Of these, 91 were national banks, 233 trust companies and state banks and 2 private banks. Their total capitalization was \$10,493,500; their surplus and undivided profits, \$7,696,000. Total resources were \$168,906,000, with loans and discounts aggregating \$91,430,000. Demand and time deposits were \$137,635,000. Per capita demand and time deposits were \$197.18; per capita savings deposits, \$87.94. The total savings of \$61,384,000 were owned by 81,460 depositors. National bank circulation aggregated \$1,899,000.

Government. The legislative body of South Dakota consists of a Senate composed of 45 members and a House of Representatives of 103 members, all elected for terms of two years, and meeting in biennial sessions limited in duration to 60 days. The chief executive is the governor elected for terms of two years at a salary of \$3,000 per year. Other executive officers are the secretary of state, auditor, treasurer, superintendent of public instruction, commissioner of schools and public lands, and attorney-general. Judicial power is vested in a supreme court, circuit and county courts, and in justices of the peace. The supreme court consists of 5 judges elected for terms of six years at salaries of \$3,000 per annum.

Social Welfare Institutions. There is a school and home for feeble-minded at Redfield, a training school at Plankinton, and a home for soldiers and their wives at Hot Springs. The hospital for the insane is at Yankton, the inmates of which run a farm. The penitentiary is at Sioux Falls.

Education. The first school was established in Bonhomme Co., between its settlement in 1859 and its separation from Minnesota in 1861. Indian massacres and the outbreak of 1862 retarded the development of the territory for several years. When South Dakota became a separate state in 1889, the constitution made provision for a complete state school system. In 1928, there were 5,404 public school buildings. The public kindergarten and elementary schools in 1927-28 had 136,501 enrolled pupils, and the public secondary schools, 28,364 pupils. Children from 8 to 16 years of age are required to attend school the full year.

The number of persons from 5 to 20 years of age attending school in 1930 was 171,834, or 72.9% of the population within the ages specified, as compared with 144,441, or 68.2%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 6,763, or 1.2%, as compared with 8,109, or 1.7%, in 1920.

Among the institutions of higher learning, the state maintains the University of South Dakota at Vermillion, the South Dakota College of Agriculture and Mechanic Arts at Brookings, the State School of Mines at Rapid City, and teachers' colleges at Aber-

SOUTH DAKOTA



IN THE BAD LANDS OF SOUTH DAKOTA

The ridges and gullies of these sterile lands are formed by the erosion of wind and water.



deen, Madison, Spearfish, and Springfield. There are government Indian schools at Flandreau, Rapid City and Pierre. Other educational institutions include the Dakota Wesleyan University at Mitchell, Huron College at Huron, and Yankton College at Yankton. The State Free Library Commission has headquarters at Pierre.

Population. In 1930 South Dakota ranked thirty-sixth among the states with a population of 692,849 or an average of 9.0 per sq. mi., an increase of 56,302 or 8.8% over 1920. The population rose from 348,600 in 1890 to 401,570 in 1900, 583,888 in 1910, and 636,547 in 1920. In 1930 there were 669,453 or 96.6% whites, 21,833 or 3.2% Indians and 646 or 0.1% Negroes. Of the whites 603,805 were native-born and 65,648 were foreign-born. Of the total foreign stock, including foreign-born, and foreign and mixed parentage, 74,337 or 25.3% were German, 55,712 or 18.9% Norwegian and 37,632 or 12.8% Russian. The rural population was 561,942 or 81.1% of the total, an increase of 27,267 or 5.1% over 1920; the urban population was 130,907 or 18.9% of the total, an increase of 29,035 or 28.5% since 1920. In 1930 the six largest cities were Sioux Falls, 33,362; Aberdeen, 16,465; Huron, 10,946; Mitchell, 10,942; Rapid City, 10,404; Watertown, 10,214.

Occupations. In 1930 247,653 persons, or 35.7% of the population, were gainful workers 10 years old or older; 84.9% of these were males and 15.1% were females; 84.1% were native white; 13.5% foreign-born white, and 2.3% other races. In agriculture, the principal occupation, 130,742 persons were engaged; of these 84,245 were farmers and 32,592 farm wage workers. Among other important occupations, with number of workers, were manufacturing, 27,682; trade, 25,570; professional service, 18,730; domestic and personal service, 16,665; transportation and communication, 15,278, and clerical service, 8,367.

HISTORY

South Dakota, sharing with New Mexico the latter designation, was perhaps first visited by a European in 1683 when the Frenchman, Charles Le Sueur, seems to have penetrated into the region around Sioux Falls. There may also have been some fur trading about 1700 between the French and Indians, but the first recorded exploration by white men was that of the two Frenchmen, the VERENDRYE brothers, who in 1742-3 came overland from Manitoba across North Dakota, wandered southwest to the Black Hills and then east to the Missouri River. In the 1780's fur traders began coming south from Canada and north from St. Louis, among them Jean Baptiste Trudeau, a fur merchant from St. Louis. In 1794 he traveled northward, exploring and buying furs, and on the Missouri River near the south border erected the first building of white men in South Dakota. The LEWIS AND CLARK expedition camped three days in August, 1804, on the site of Yankton, and explored the Missouri River through the entire Dakota territory. The first permanent white settlement was made in 1817

by Joseph La Framboise, who established a trading post near Pierre. George Catlin, Indian painter and ethnologist, was a passenger in the summer of 1832 on the steamboat *Yellowstone* on its second trip up the Missouri River for the American Fur Company, and spent some time at Fort Pierre, studying and painting the Indians. In 1838-39 Gen. Frémont and J. N. Nicollet, geographer and astronomer, explored much of the territory. The first agricultural settlement was made in 1856 near Sioux Falls by a party from Minnesota, but six years later this and others made afterward were abandoned because of Indian outbreaks.

Dakota Territory was created by Congress in 1861 with Yankton as its capital, but its growth was very slow until gold was discovered in the western part in 1874. In what is now South Dakota the consequent rush developed exceedingly rich placer mines and, later on, large ore bodies, among these being the Homestake Lode, one of the world's greatest gold mines. In the next decade homesteaders and settlers poured in, the population almost tripling in five years. The territory was divided, and North and South Dakota with their present boundaries were admitted as states Nov. 2, 1889, with Pierre the capital of South Dakota, which had a population of 348,000. Recurrent Indian warfare retarded development in the earlier years. After 1890 came repeated droughts that depleted the population, shrank values and stopped immigration until near the turn of the century, when better climatic conditions brought big increases in population and farm values. Although normally Republican, South Dakota voted for Roosevelt and elected Tom Berry, Democrat, governor. Peter Norbeck, Republican, was reelected to the Senate.

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SOUTH DAKOTA, UNIVERSITY OF, at Vermillion, S.D., a coeducational state-controlled institution, for which provision was made by act of the territorial legislature in 1862. Nothing was done toward the establishment of the institution until 1881, when Congress granted public lands to Dakota for a university when the territory should become a state. Instruction was begun in 1883. The university consists of colleges of Arts and Sciences, Music and Engineering, and schools of Law and Medicine. The operating income in 1931 was \$488,405. The library contained 72,500 volumes. In 1931-32 there was a student enrollment of 984, and a faculty of 92, headed by Pres. Herman G. James.

SOUTHEND, a seaside resort of Essex, England, situated on the Thames estuary, 40 mi. east of London. It is a popular amusement place, with good level sands, the longest pier in England and a promenade 8 mi. long. Southend-on-Sea, as it is known, dates from 1804, when it was visited by Queen Caroline. Leigh-on-Sea, with a 13th century castle, and West-cliff-on-Sea are suburbs. Pop. (of county borough) 1921, 106,010; 1931, 120,093.

SOUTHERN CALIFORNIA, UNIVERSITY OF, an institution for men and women, located at Los Angeles, Cal., was founded in 1879. It is privately controlled and is related to the Methodist Episcopal Church. Its departments include Metropolitan College, College of Dentistry, College of Pharmacy, Medical and Law Schools, and the Marine Biological Station. The valuable collections contained in Exposition Park, which is adjacent to the university, are available to students. The university had productive funds in 1931 amounting to \$1,700,000. The library contained 142,000 volumes. In 1931-32 there was an enrollment of approximately 16,000 students, and a faculty of 550, headed by Pres. RUFUS B. VON KLEINSMID.

SOUTHERN CROSS, a brilliant constellation in the southern hemisphere. See CRUX; STAR: map.

SOUTHERN METHODIST UNIVERSITY, a coeducational institution located at Dallas, Tex., chartered in 1911. It is controlled by the Methodist Episcopal Church, South. The productive funds in 1931 amounted to \$2,306,566. There were 76,780 volumes in the library. In 1931-32 there was a student enrollment of 3,218, and a faculty of 150 headed by Pres. Charles C. Seelman.

SOUTHERN OCEAN, a name used synonymously with ANTARCTIC OCEAN. It is derived from the fact that the waters included within it are southern extensions of the Pacific, Atlantic and Indian oceans which have been separated from the main bodies by an arbitrary boundary.

SOUTHERN PINES, a town in Moore Co., North Carolina, situated about 5 mi. east of Pinehurst and approximately 60 mi. southwest of Raleigh. It is on the route of a U. S. Interstate highway and also on the Seaboard Air Line Railroad. A mild winter climate and excellent facilities for recreation have made the town a favorite winter resort, visited particularly by Northerners. Resident pop. 1920, 743; 1930, 2,524.

SOUTHEY, ROBERT (1774-1843), English poet and writer of prose, was born in Bristol, Aug. 12, 1774. He was expelled from the Westminster School for writing an article against flogging; in 1792 he entered Balliol College, Oxford. Two years later he met SAMUEL TAYLOR COLERIDGE and with him and another friend formed a fantastic scheme to emigrate to America and found a social Utopia; this plan, however, fell through. In 1795-96 Southey traveled in Portugal and Spain. He studied law a short time, but soon turned to literature. He joined Coleridge at Keswick in the Lake District in 1803, settling permanently at Greta Hall. The history of literature can show few instances of such untiring industry as Southey's. His longest poems undertake to reveal the picturesque side of world religions, as *Thalaba*, 1801, *Madoc*, 1805, *The Curse of Kehama*, 1810, often considered his foremost work, and *Roderick*, 1814. He excelled in prose and devoted the latter part of his life to it. He possessed a simple, unaffected style which makes his histories and biographies de-

lightful, his most notable works being the *Life of Wesley*, 1820, *Cowper*, 1833-37, and the schoolboy's favorite, *Nelson*, 1813. Southey became Poet Laureate in 1813, by which time his revolutionary ideas had subsided into conservatism. There was considerable enmity between him and LORD BYRON. His chief friends were Wordsworth, Coleridge and Landor, with whom he corresponded in a series of charming letters. Southey died at Greta Hall, Mar. 21, 1843, and was buried in Crosthwait churchyard. See also ENGLISH LITERATURE; LAKE SCHOOL.

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SOUTH GATE, a city in Los Angeles Co., southern California, situated 7 mi. south of Los Angeles. The Southern Pacific Railroad and Union Pacific and the Los Angeles Street Railway afford transportation. Local manufactures include paper products, hardware, knitted goods, chemicals, automobile tires, rubber goods, clay and concrete products, soap and fabricated steel. The retail trade in 1929 reached a total of \$3,530,736. Pop. 1920, 500; 1930, 19,632.

SOUTH GEORGIA ISLAND, in the South Atlantic Ocean, lying about 800 mi. southeast of Falkland Islands and attached to them for administrative purposes. The island is about 1,000 sq. mi. in area, with a barren, mountainous surface, snowcapped peaks rising to 8,000 ft. above the water. Deep, glacial gorges cut between the ridges and give the region a bleak aspect. There is a small settlement at Grytviken but the island is practically uninhabited. Whaling is the only industry.

SOUTH HADLEY, a town and village in Hampshire Co., southwestern Massachusetts. The town is bounded on the west by the Connecticut River. The village is situated about 11 mi. north of Springfield. Connected by an electric street railway with Holyoke, it is thus served by the Boston and Maine and the New Haven railroads. South Hadley has paper mills, and is the seat of Mt. Holyoke College for women. In the southern part of the town is the village of South Hadley Falls. The District of South Hadley, established in 1753, became a town in 1775. Pop. 1920, 5,527; 1930, 6,773.

SOUTHINGTON, a town with a borough of the same name, in Hartford Co., Conn., situated 18 mi. southwest of Hartford. Bus lines and the New Haven Railroad afford transportation. Southington is located in fertile agricultural country. The chief industries are the manufacture of plumbing supplies, hardware and cleaning fluids. Southington was founded in 1779. Pop. of borough, 1920, 5,085; 1930, 5,125.

SOUTH JACKSONVILLE, a city of Florida, one mile southeast of Jacksonville. It is in an agricultural community producing fruit, truck crops and poultry. There are also industrial plants here, including shipyards, machine shops and saw and paper mills. Pop. 1920, 2,775; 1930, 5,597.

SOUTH KINGSTOWN, a town of southern Rhode Island, in Washington Co. It is situated about 23 mi. south of Providence and is served by two rail-

roads and by bus lines. Located on the ocean. South Kingstown attracts summer colonists. Fishing is important, and the town manufactures chiefly worsteds and woolen goods. It is the seat of Rhode Island State College. Pop. 1920, 5,181; 1930, 6,010.

SOUTH MANCHURIA RAILWAY, the Japanese-owned railway in South Manchuria, operated by the semi-governmental South Manchuria Railway Company. Under 1896 agreements with China, Russia built the Chinese Eastern Railway, with a main line running across North Manchuria and a branch running southward from Harbin to Port Arthur and Dairen. With this railway went important mining rights, and the right to administer the area within the railway zone, which was a narrow strip along the railway line with enlargements at the principal stations and mining areas. As a result of the Russo-Japanese War of 1904-5, Japan took from Russia the railway and appertaining rights from Changchun south, a length of 469 miles. This transfer was agreed to by China on Dec. 22, 1905. During the war Japan had built a light military line from Mukden, now Shenyang, southeastward to Antung, on the Korean border. Japan secured from China, Dec. 22, 1905, the right to reconstruct this line and operate it. This line, 162 miles long, was made part of the South Manchuria Railway system. Subsequent construction of branch lines, including one to Yinkow, brought the total mileage up to 690.8 miles at the end of 1931. The total area of the railway zone is 100 square miles.

The original Sino-Russian agreement provided that China might buy the Chinese Eastern Railway at the end of 36 years from its opening, and that it would pass to China without charge at the end of 80 years. The line was formally opened July 1, 1903. The agreement for the Mukden-Antung line specified that the concession was for 15 years after the completion of reconstruction, but reconstruction was to be completed within three years. The original concession expired Dec. 22, 1923. By the terms of the "twenty-one demand" treaties of 1915, Japan unconditionally secured the extension of the terms of the South Manchuria Railway and the Antung-Mukden Railway to 99 years, making the expiration date on the main line 2002, and on the Antung-Mukden line 2007. The Japanese insist that these 1915 treaties are valid. The Chinese contend that they are not.

Immediately after securing control of the railway lines, Japan proceeded to change them to standard gauge. In ensuing years she improved the roadbed, double-tracked portions, built new stations, etc., and made of the South Manchuria an exceptionally well-equipped and efficiently run line. In the fiscal year ending Mar. 31, 1930, the railway carried 10,410,579 passengers and about 20,461,816 tons of freight. Net profits on the railway for the year were Yen 74,890,235 (\$37,445,117).

SOUTH MANCHURIA RAILWAY COMPANY, the semi-governmental Japanese company which was formed in 1906 to own and operate the

railway lines and related interests in South Manchuria acquired by Japan as a result of the Russo-Japanese war of 1904-5. Half the stock in the company is owned by the Japanese Government; private individuals, but only Chinese or Japanese, or the Chinese Government may subscribe to the other half. At the end of 1931, all the non-Japanese Government stock was held by Japanese individuals. The president, vice-president and directors of the company are appointed by the Japanese Government, though the directors must be named from among the stockholders. The Japanese Government retains final authority over the company under the following provisions of the statutes: "Article XIII—the Government may issue such orders as may be necessary to superintend the business of the company. The Commander-in-Chief of the Kwantung garrison may issue necessary instructions regarding the company's business as it affects military matters." The second sentence gives the military authorities the right to commandeer for military purposes any part of the company's property which it needs.

The South Manchuria Railway Company has been the general agent of the Japanese Government in developing Japanese economic interests in Manchuria. The Fushun collieries, the Anshan iron works and various electric, gas, ceramic, machine manufacturing and other enterprises have been built up by the company. The company also has established and operated agricultural experiment stations, research laboratories, hotels and a wide variety of activities, including schools and hospitals, for improving conditions generally. It has been primarily responsible for the development of the port facilities at Dairen. In some cases, when enterprises started by the company have become well established, they have been turned over to nominally independent companies.

The investments of the South Manchuria Railway Company, on Mar. 31, 1930, amounted to Yen 1,034,593,658 (\$517,296,829), or 61% of the total Japanese investments in Manchuria of Yen 1,687,601,531 (\$843,800,765) as reported in statements by the company. Net profits of the company had grown steadily in recent years, reaching a figure of Yen 45,505,857 for the fiscal year ending Mar. 31, 1930, but profits fell off heavily in the next year, being only Yen 21,673,462 for the year ending Mar. 31, 1931. Fixed investments amounted to Yen 750,190,880 on Mar. 31, 1931, and stock issued totaled Yen 387,156,000 of which the Japanese Government held Yen 220,000,000 or half of the total authorized stock.

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SOUTH MILWAUKEE, a city in Milwaukee Co., southeastern Wisconsin, situated on Lake Michigan, 10 mi. south of Milwaukee. It is served by the Chicago and North Western Railroad. The airport is 2 mi. south. The city has factories producing chiefly excavating machinery and electric line materials. The

retail trade in 1929 amounted to \$3,953,658. South Milwaukee was incorporated in 1897. Pop. 1920, 7,598; 1930, 10,706.

SOUTH ORANGE, a rapidly growing village of Essex Co., N.J., located 13 mi. west of New York City and adjacent to Newark on the west. Its transportation facilities include the Lackawanna Railroad, electric trolleys and motor bus lines. The village is situated partly in a valley and partly on sharply rising ground which affords a superb view of the entire Metropolitan district. South Orange is a residential suburb characterized by large and beautiful homes. The retail trade in 1929 amounted to \$7,738,245. Pop. 1920, 7,274; 1930, 13,630.

SOUTH PASADENA, a residential suburb in Los Angeles Co., southern California, contiguous to Los Angeles City. It is served by electric railway and three railroads, and is entirely surrounded by other cities. The public schools of South Pasadena are of outstanding merit and beauty. The retail trade of South Pasadena in 1929 amounted to \$3,616,438. Spanish missionaries came here in 1770. The site of Pasadena and Southern Pasadena was once known as Rancho San Pasqual, the land given to Dona Eulalia Prez de Guillon in 1827 for her devotion as a teacher and nurse to the Indians. She is said to have died in her 143rd year. The Americans settled here in 1870; South Pasadena was incorporated in 1888. Pop. 1920, 7,652; 1930, 13,730.

SOUTH PLAINFIELD, a borough of Middlesex Co., N.J., located 45 mi. southwest of New York City and 11 mi. north of New Brunswick, N.J. It is contiguous with Plainfield, N.J., divided from it by the county line and is an integral part of the metropolitan district consisting of Plainfield, North Plainfield and South Plainfield, N.J. It is the junction point of the main line and Perth Amboy division of the Lehigh Valley Railroad, and it has a number of manufacturing establishments producing steel products. Pop. 1930, 5,047.

SOUTHPORT, a seaside resort and municipal borough of Lancashire, England, situated along a fine, sandy beach often used for automobile speed tests, about 18 mi. northwest of Liverpool. Unknown a century ago, to-day it is the gathering place of thousands of holiday seekers from the surrounding industrial areas, particularly in the summer season. Enhancing its native attractions of location and climate, are a 2-mi. marine promenade, a mile-long pier, botanic and other gardens, parks and a fine artificial lake. Pop. 1921, 76,621; 1931, 78,927.

SOUTH PORTLAND, a city of southwestern Maine, in Cumberland Co. It is situated on Fore River, opposite Portland, with which it is connected by three bridges and a ferry. The city's industries include sardine packing, shipbuilding, rolling mill and machine shop work, stone-cutting and the making of paint and varnish. It is also an oil distributing center. The retail trade in 1929 amounted to \$2,140,897. The government fortifications and the Soldiers' Monument are of interest. Pop. 1920, 9,254; 1930, 13,840.

SOUTH RIVER, a borough of Middlesex Co., N.J., located on the Raritan River Railroad, 5 mi. southeast of New Brunswick. The district is rich in deposits of clay, sand and gravel, and South River is an important center for the production of bricks and ceramic products. Its industries also include the manufacturing of cigars, laces and embroideries. In 1929 the retail trade reached a total of \$3,899,914. It was founded by Samuel Willett in 1720 and incorporated as a borough in 1898. There is a small local assessment, but the cost of government is nearly met by the operation of borough-owned public utilities. Pop. 1920, 6,596; 1930, 10,759.

SOUTH ST. PAUL, a city in Dakota Co., southeastern Minnesota, situated on the Mississippi River, 3 mi. from St. Paul. The Rock Island and the Great Western railroads serve the city, which has belt-line connections with all northwestern lines. Packing houses, stock yards, tanneries and railroad shops afford industrial activities. In 1929 the retail trade amounted to \$4,370,536. The vicinity is rich in Indian legends. Pop. 1920, 6,860; 1930, 10,009.

SOUTH SAN FRANCISCO, an industrial city in San Mateo Co., western California, on San Francisco Bay, nine mi. south of San Francisco. It is served by bus lines, electric street railways, and the Southern Pacific Railroad. The steel industry and meat packing are the city's leading industries. South San Francisco was founded in 1896 and incorporated in 1908. Pop. 1920, 4,411; 1930, 6,193.

SOUTH SEA BUBBLE, a name given the various commercial activities of the South Sea Company which was formed in England in 1711, and which received from the government a monopoly of South American trade and trade with several Far Eastern countries. The company engaged in many speculative ventures which proved very unprofitable to investors, causing the company to go out of business.

SOUTH SEA COMPANY. See SOUTH SEA BUBBLE.

SOUTH SEA ISLANDS, the name usually given to the islands in the South Pacific Ocean. They number about 2,600, and fall into three groups, namely, Melanesia, or Black Islands, Micronesia, or Little Islands and Polynesia, or Many Islands. The chief islands of Melanesia are the Solomons, Santa Cruz and Fiji, all of which are British. The New Britain Archipelago, formerly known as the Bismarck Archipelago, is under an Australian mandate. The New Hebrides are governed by a Condominium. The Micronesia archipelago contains the Caroline, Marshall, Marianna and Pelew islands. This group, with the exception of the British and American islands, is administered by Japan under a mandate from the League of Nations. Guam, in the Marianas, is American, and the Gilbert Islands are British. The terms of the Peace Treaty (1919) have thus made Britain, Japan and the United States close neighbors in the South Seas. Polynesia is an enormous group stretching from Hawaii to New Zealand. Most of the islands are small, and many are of coral

formation. They were first discovered by the 18th century explorers, who were followed by missionaries, traders and whalers in the 19th century. Tonga, Western Samoa, Cook Islands and other smaller groups are British. Tahiti and the other Society Islands, Paumotu and the Marquesas belong to the French. Hawaii and Eastern Samoa are American. The Mariannas (or Ladrones) were discovered by Magellan in 1521, the Marquesas by Mendana in 1595, but it was not until 1767 that Wallis, and subsequently Cook, explored and described the chief islands. See separate articles on these islands.

SOUTH SHIELDS, a seaport of Durham, England, near the mouth of the Tyne, 9 mi. northeast of Newcastle. North Shields is on the opposite bank of the river, and the ports, formed by an expansion of the Tyne into a wide bay, have recently been improved greatly by dredging and by the construction of piers, and can now accommodate large vessels at their wharves. South Shields is also an industrial center, with shipbuilding, boiler, glass, chemical and rope works. The Romans had an important fort on an eminence overlooking the river; a portion of the fort containing the remains of the forum, treasury and western gateway, has been laid out as a recreation center. The fort was captured by the Scots in 1644. Pop. 1921, 17,135; 1931, 20,583.

SOUTH VICTORIA LAND, a plateau in Antarctica, extending from 71° S. lat. to the south pole between 160° to 170° E. long. The region was discovered by Sir James Clark Ross in 1841, and has been shown to be a plateau bounded along the Ross Sea by a great horst, 50 to 100 mi. wide and rising to 13,000-15,000 ft.

SOUTHWELL, ROBERT (c. 1561-95), English poet and Jesuit martyr, was born at Horsham, Norfolk, about 1561. He was educated at Douai, France, went to Rome and returned to England in 1584 as a missionary priest of the Jesuit Order. That same year a law was passed forbidding any priest who was an English subject to live in England. Southwell, however, was not arrested until 1592; then, for three years he was imprisoned and subjected to torture. His poems are of a meditative and devoutly religious nature and show rare talent; they were not published until after his death. Among the best known are *Saint Peter's Complaint* and *Burning Babe*. Southwell was hanged in London, Feb. 21, 1595, and in 1929 was beatified.

SOUTH-WEST AFRICA, a mandated territory lying along the southwest coast of Africa, comprising an area of 332,400 sq. mi. and included for purposes of administration under the government of the Union of South Africa. It is bounded on the west by the Atlantic Ocean, on the east by Bechuanaland, on the south by Cape Province and on the north by Angola. The country is mostly a plateau lying at an average height of 4,000 ft., with the highest point of land, Mt. Moltebick, rising to 7,886 ft. The surface is generally barren, interrupted by occasional belts of forests and bushlands. In those sections favored by rain maize

and vegetables are raised, but the dry and hot climate does permit of agriculture on a wider scale. The country is, however, better suited to live stock raising, and cattle, sheep and goats are bred. The minerals include diamonds, which are the most valuable export, copper, cassiterite or tin, vanadium and marble. The capital, with a population of 4,600 Europeans and about 10,000 natives, is Windhoek. The total population of the territory in 1926 was about 261,000 of which 24,115 were Europeans. Native races represented include the Bushmen, Ovambos, Hereros, Berglamaras or Klipkaffirs, and Hottentots, while the region just south of Windhoek is occupied by a race called the Bastards who possess a considerable measure of European blood, speak Cape Dutch instead of a native tongue and participate in their own government.

Annexed by Germany in 1884, the territory was known as German South-West Africa until 1915, when the forces of the Union of South Africa, after many months of fighting, finally overthrew the German colonists at Khorab. In 1920 the League of Nations gave the Union of South Africa a mandate over the conquered territory.

SOUZA, MARTIM AFFONSO DE (c. 1500-1564), Portuguese navigator and colonizer. In 1530 he was sent as first governor to Brazil to establish formal control, and recommended dividing the country into captaincies. This was done in 1532, and he received for himself the captaincy of Sao Vicente, which he had settled. The next year, however, he returned to Portugal, and was appointed admiral of the Portuguese fleet of the East Indies. His administrative ability was not great and he was shortly supplanted, and returned to Lisbon.

SOVEREIGN, a British gold coin equal to the POUND STERLING and equivalent to \$4.87 until England discarded the gold standard in the fall of 1931. In Oct., 1931, the sovereign was exchanging for about \$3.90 and its stabilization was awaiting the outcome of the British economic crisis.

SOVEREIGNTY has been defined as the supreme power of the STATE over its citizens (*see* CITIZENSHIP) and subjects unrestrained by law. A distinction must be drawn, however, between the legal and the actual sovereign. The former is a determinate body with authority to express in legal formula the highest commands of the state; the latter, that power, frequently totally unknown to the law, which in reality actually dominates the legal sovereign. In one sense the actual sovereign may be the electorate, or certain organs of government, which can alter or amend the constitution, "King in Parliament" (Great Britain), National Assembly (France), state legislatures or state conventions by an extraordinary majority (United States). In another sense, the whole mass of the population including every person who could contribute to the moulding of public opinion may constitute the actual sovereign. One of the most interesting aspects of the problem of sovereignty is the question of its divisibility.

S. C. W.

See J. W. Garner, *Introduction to Political Science*, 1910.

SOVIET CENTRAL ASIA, a territory with approximately 8,000,000 inhabitants comprising Uzbekistan, Turkmenistan, Tadzhikistan, the Kirghiz Autonomous S.S.R. and the Kara-Kalpak autonomous area. **UZBEKISTAN**, with an area of 66,380 sq. mi. and a population of 4,585,000, is a primitive land whose citizens are chiefly Uzbeks, followers of Islam; it was organized as a Soviet Republic in 1924. **TURKMENISTAN** has an area of 173,330 sq. mi. and a population of about 1,116,540. Turcomans are the predominant race. Agriculture, rug weaving and mining are important occupations. This region also became a Soviet Republic in 1924. **TADZHIKISTAN** has an area of 54,750 sq. mi. and a population of about 1,156,000 mainly engaged in farming, especially cotton-raising and cattle breeding. Organized as a republic in 1929, its inhabitants, the Tadzhiks, are well advanced and progressive. Uzbekistan, Turkmenistan and Tadzhikistan all have dry climates and sandy soil where artificial irrigation is necessary for the growing of cotton, rice, grain and other products.

The Kirghiz Autonomous Republic lies northeast and the Kara-Kalpak autonomous area northwest of Uzbekistan, and together they have over 1,400,000 inhabitants. In 1930 the Kirghiz Autonomous Republic had a population of 1,083,500 and the Kara-Kalpak Autonomous Area had 329,870 people. They are composed of various Kirghiz tribes with a minority of Uzbeks and numbers of Kazaks and Russians. Cattle breeding and farming support the natives who make their homes in fertile, narrow, mountain valleys. Both in their mode of living and in their culture the Kirghiz rank above other tribes of Central Asia. The chief connecting link of Central Asia with Siberia and other parts of the Soviet Union is the Turkestan-Siberian Railway, about 900 mi. long, opened in 1930.

SOVIET COOPERATIVE ORGANIZATIONS. The Soviet administration has transformed the Russian cooperative movement, which had its origin in the Czarist régime in 1865. The present form and function of the cooperatives are closely adapted to the general plan of the economic life of the Soviet Union. Instead of being conducted primarily for the benefit of their members, as in other countries, cooperatives in Soviet Russia are, first of all, instruments for the further development of a socialist society. Their particular rôle has to do with wholesale and retail trade.

The combined membership of consumers', producers' and agricultural cooperative societies in the U.S.S.R. in 1929 amounted to 34,000,000, a total far greater than that of any other country. Consumers' societies are the largest and most important group. Membership in consumers' organizations is voluntary, but it has been almost necessary for the purchase of the necessities of daily consumption at a time when the private trader has practically disappeared. Individual consumers' societies are combined in unions and are served by a central organization known as *Centrósoyus*. *Centrósoyus* buys goods from the syndicates (selling organizations) of the manufacturing industries and distributes them to the local

societies. It also operates mills and factories on its own account.

Producers' societies are confined to small-scale industry. Their unit is the *ARTEL*, the members of which work in their own homes at various handicrafts, or in shops for wages which must not exceed a fixed maximum. Agricultural cooperative societies underwent great changes during the acceleration of the collectivization movement in agriculture in 1930. The collective farms (*Kolhozy*) then organized were served by a central purchasing organization, *Selskýsoyus*, and by various centers organized for particular products, such as the grain center, the poultry center and the linen center. Each of the main branches of the cooperative movement has local and provincial organizations in the federated republics and each has transactions with the All-Russian Cooperative Bank. A. H.E.

BIBLIOGRAPHY.—C. B. Hoover, *The Economic Life of Soviet Russia*, 1931; Stuart Chase and others, *Soviet Russia in the Second Decade*, 1928.

SOVIET RUSSIA. See **UNION OF SOCIALIST SOVIET REPUBLICS.**

SOVIET TRADE ORGANIZATION. The People's Commissariat for Trade, *Narcomtorg*, is charged with the general regulation of all trade within the Soviet Union. In 1930 *Narcomtorg* was reorganized and given the direction and planning of the food industry and of the new combinations set up for state industries, as well as control over the consumers' and agricultural cooperatives.

The centralization of trade in the hands of *Narcomtorg* is not so great as the control over industry exercised by the Supreme Economic Council. This is due in part to the participation of the state trusts for industry in the commercial life of the country and in part to the existence of consumers' organizations of long standing (see **SOVIET COOPERATIVE ORGANIZATIONS**). Private trade suffered a decline after its early years under the new economic policy of 1921, and in 1928-29 it accounted for only 19.5% of the retail goods turnover. In that year the cooperatives, with 57.4% carried on the major part of the country's trade, and the state trading organizations accounted for the remaining 23.1%. Since that time the private trader has tended to disappear. Theoretically he is free, but he has been cut off from his supplies of goods and from the use of buildings. The cooperatives have absorbed his trade, and show signs of soon becoming the chief trading organizations of the state. Wholesale trade is carried on by the combinations, which are agents of particular state industries, other state organizations and the cooperatives.

Foreign trade has been a government monopoly since the establishment of the Soviet state. It remained a monopoly even during the period when the new economic policy permitted private trading within the country. In Nov., 1930, the Commissariat for Trade was divided into the Commissariat for Foreign Trade.

State control of foreign trade has given the Soviet Union unusual opportunities for promoting its indus-

trialization program. Urgently needed machinery and other goods have been bought abroad by selling Russian agricultural and industrial products, even when the home demand and the (nominal) domestic price have indicated the home market as the obvious one. Soviet trade has become independent of gold movements to an extent rarely found in other countries.

A. HE.

BIBLIOGRAPHY.—*Soviet Union Year Book*; W. H. Chamberlain, *Soviet Russia*, 1930.

SOW THISTLE, a genus (*Sonchus*) of coarse annual or perennial herbs of the composite family, several of which are widespread as weeds. There are about 45 species native to the Old World, four of which are naturalized in North America. They are usually smooth plants with lobed or coarsely toothed, prickly margined leaves, yellow flower-heads in terminal clusters and achenes bearing a pappus of profuse, soft, white bristles.

SOYBEAN (*Glycine Max*), an important food, forage and soiling plant of the pea family closely allied to the kidney bean. It is native to China and Japan where it has been cultivated since remotely ancient times. The plant is an erect, hairy, bush annual, 2 to 6 ft. high, with leaves of three oblong leaflets, small white or purple flowers and numerous brown, bristly-hairy pods containing 2 or 3 globular seeds. It is the most prolific seed producing legume, a single plant sometimes bearing 400 pods. In eastern Asia the soybean is grown in enormous quantities for human food, especially in Japan where, because of its very high protein content, it largely takes the place of meat. In the warmer parts of Europe and the United States the soybean is extensively grown as a forage and soiling crop. The chief product of the bean is soybean oil used in making paints, varnishes, soaps, lubricants, linoleum and for numerous other purposes. A ton of soybeans yields about 250 lbs. of oil and 1,600 lbs. of meal, utilized for stock feed and fertilizer. The statistics of production in the United States are as follows:

SOYBEAN PRODUCTION, U.S.

2-Year Average, 1929-30

Division	Acreage	Production (Bu.)	% of Tot. Prod.
UNITED STATES	1,532,000	19,574,000	100.0
LEADING STATES:			
Illinois	311,000	5,036,000	25.7
Nor. Carolina	286,000	3,843,000	19.6
Indiana	170,000	2,390,000	12.2
Missouri	171,000	1,663,000	8.5
Tennessee	110,000	1,259,000	6.4
Louisiana	101,000	1,002,000	5.1
Ohio	66,000	920,000	4.7

SPA, CONFERENCE OF, a meeting held on July 5-16, 1920, by the participating nations of the World War in which the delegates discussed the provisions for German disarmament and for the delivery of coal under the TREATY OF VERSAILLES without prejudice to the rights of the defeated nations. The Allies agreed among themselves on the proportional distribu-

tion of future reparation payments to them. Germany signed protocols dictated to her under threat of military sanctions and occupation of the Ruhr basin by the Allies, and agreed to a proposal for trying the Kaiser and other "war criminals."

SPACE and TIME, terms used in philosophy to describe the phenomena of coexistence and sequence. It is easier to describe space and time than it is to say what they are. Space has the property of extensity, and time that of duration. The one may be represented by a series of coexisting points, the other by a series of successive instants. Yet they are both continuous, and how out of a series of points, which are unextended, is extension to be generated, and how out of a series of instants, which stand for innumerable stops, is the flow of time to be born? The answer is in the relation between the points and instants of the respective series. A continuous series is generated only when it stands in a one-to-one correlation with its proper part, that is, when there are as many points in one of its parts as there are in the whole. Between any two points of such a series there are an infinite number of points.

The concepts of space and time gave the Greeks much trouble. The atomists had to introduce empty space in order to account for the motion of atoms, but for the most part among the Greeks, empty space was not accepted. Space was regarded as a plenum and the void could not be conceived. Among the ancients space and time had objective existence. It is not until we come to modern philosophy that they become subjective. This is best illustrated by the position of IMMANUEL KANT, who made them *a priori* elements of the sensibility. They were the forms which objects of sense must take. One could abstract all other qualities from objects; but the elements of space and time are necessary to their appearance in sense. It does not follow from this, however, that things-in-themselves possess either spatial or temporal characteristics. In fact Kant believed that these forms did not apply to the noumenal world. There is one marked difference between the spatial and the temporal order, for it is possible to move to either side in space whereas time cannot march backwards.

The theory of relativity has given rise to a four dimensional continuum known as SPACE-TIME.

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SPACE-TIME. The geometry of the world is treated by the Euclidean method in three dimensions, with lengths measured along three mutually perpendicular axes, whereas time is treated as a separate entity. Minkowski deviated from Euclidean geometry to include time with space, to form a world of four dimensions. He would say space-time rather than space and time. Imagine a ball rolling slowly in a straight line along a table top in front of a fixed camera. A picture is taken each second as the ball moves across the table. When the pictures are developed and placed on top of each other, there will be

a series of black dots extending upwards and to the side. This is a two-dimensional picture of the ball, the horizontal dimension being space and the vertical, time. Enlarging this idea to include three-dimensions of space and one of time, one can conceive, although one cannot picture, a four-dimensional plot of an airplane flying through space-time. Such a world is spoken of as the *continuum*, and the path of a body in this geometry when they occur at the same place at the same time, i.e., when two world lines intersect.

The theory of RELATIVITY still further modifies the concept of space-time by stating that the units of space and time depend on where the clocks and measuring rods are located, whether on a moving body or a fixed frame of reference.

By considering that the physical laws of a body in a gravitational field are the same as those of a body in a frame of reference moving with uniformly accelerated motion, EINSTEIN has shown that the velocity of light is altered slightly in passing near a body such as the sun and is slightly deviated from its straight-line path. The geometry of Riemann, which is used to develop this mathematically, proposes that space itself is curved by an amount depending on the distribution of matter over space. In other words, the light from a distant star which passes the sun, instead of suffering a deviation, travels in a "straight line" through a space curved by the gravitational field of the sun. J. B. H.

SPADEFISH (*Chaetodipterus faber*), a marine fish allied to the angel-fishes, found from Cape Cod to Rio de Janeiro and especially abundant in the West Indies. It has a very deep, compressed body, about 2 ft. long, and a strongly arched back. Most spade-fishes are marked with black and white bars, but in old fishes these often disappear. The spade-fish has pleasantly flavored, white flesh and in the tropics is extensively used for food. See also ANGEL-FISH.

SPADE GUINEA, an English GUINEA having a spade-shaped shield bearing the coat of arms on one side. It was coined only during the latter part of the 18th century.

SPAGHETTI. See PASTES, ALIMENTARY.

SPAHLINGER, HENRY (1882-), Swiss bacteriologist, was born in Geneva on Aug. 8, 1882. He devised a treatment for pulmonary tuberculosis based upon two different principles—destruction of tuberculous toxins by injecting serums and therapeutic vaccination with a series of tuberculins.

SPAIN, a European republic which with Portugal forms the great southwestern prolongation, or Iberian Peninsula, of the Continent—"the end of the world" or *finis terrae* of ancient and medieval times.

Spain is connected with the continent on the northeast by the Pyrenees Mountains, which separate it from France; it is bounded on the east and south by the Mediterranean and on the west by Portugal and the Atlantic Ocean. Measured diagonally, its greatest length from Cape Creux in the northeast to Cadiz, in the southwest, is a distance of 656 mi. Its

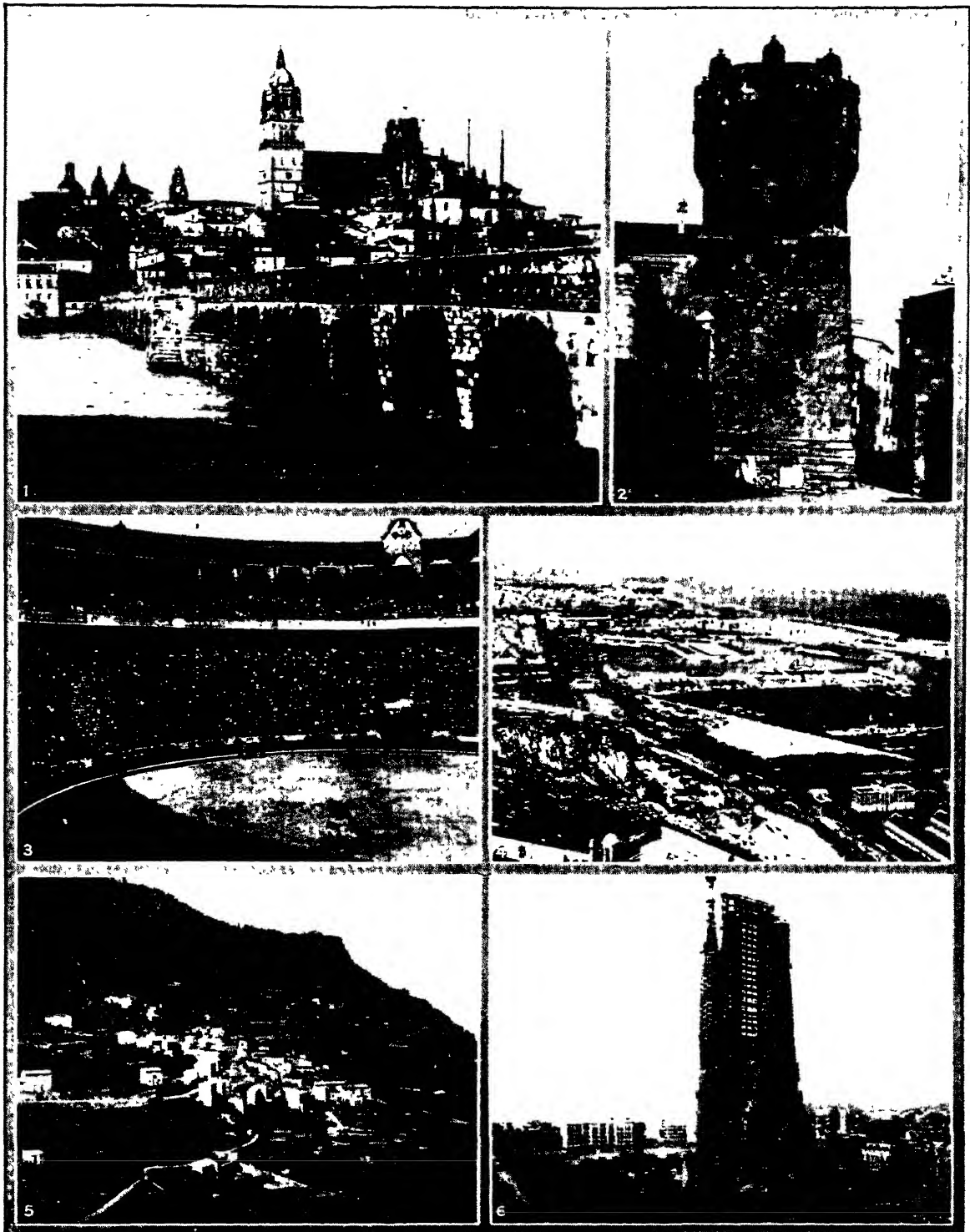
greatest breadth is from Cape Ortegal in the northwest to Cape Palos in the southeast, a distance of 583 mi. Excluding the Canary and Balearic Islands, which belong to Spain and have a combined area of 6,557 sq. mi., the area of Spain proper is 190,050 sq. mi. The coast line is only slightly broken and sweeps round in gentle curves for 1,370 mi., about 600 mi. of which belong to Bay of Biscay and the Atlantic Ocean, and 770 mi. to the Mediterranean. Much of the Atlantic coast is rocky but its elevation does not exceed 300 ft. Although the water is deep on the north, there is little sheltered anchorage. In the northwest there are excellent harbors, of which Vigo and Ferrol are the best known. In the south the Bay of Cadiz makes a good harbor. High cliffs at first appear at Cape Trafalgar and there become more and more elevated until they suddenly rise into the famous Rock of Gibraltar, 3 mi. in length, $\frac{3}{4}$ of a mile in width and 1,439 ft. high. At a much lower elevation the coast continues east, with harbors at Málaga and Cartagena, but becomes bold and rocky again till near the Gulf of Valencia, beyond which is Barcelona, the most important Spanish port.

Surface Features. There are five principal chains of mountains: the Pyrenees which, though partly in France, present their boldest front to Spain and have their highest summits within it; the chain which divides the basins of the Duero (Port Douro) and the Tagus (Spanish *Tajo*; Port Tejo) rivers called the Sierras Guadarrama, Gredos and Gata; the mountains of Toledo, chiefly comprising the Sierra Guadalupe; the Sierra Morena; and the Sierra Nevada, extending from Cartagena to Cadiz, and containing the Cerro Mulhacén, the highest summit in Spain, 11,417 ft. above sea level. The characteristic feature of the interior of Spain is its central tableland, which has an elevation of from 1,000 to 3,000 ft. with a superficial extent of not less than 90,000 sq. mi. It is sometimes called the Plateau of Castile, is nearly surrounded by mountains and is itself very rugged.

The rivers of Spain, although many, rise in general in the tableland where rain is scarce, so that their depth is not great and navigation is limited. The most important belonging to the Mediterranean basin are the Ebro, rising in the Asturias, with a course of more than 400 mi., the Segura and Jucar, each with a course of 200 mi., and the Guadalquivir, with its 150 mi. The chief rivers of the Atlantic basin are the Duero and Tagus, whose lower and most valuable extents are in Portugal. The Guadalquivir, flowing between the Sierras Morena and Nevada, has more water than most, but its 400 mi. are navigable only a short distance beyond Seville. Considering its mountains, it is remarkable that Spain does not possess any lakes worthy of mention.

Climate. The climate varies. It is warm on the coast, but the tablelands have extreme heat in summer and extreme cold in winter. In the north rains are frequent, but in the southeast and in lower Aragon the rain may not fall for years. The mean annual temperature is about 60° F. The annual rainfall on

SPAIN



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CHARACTERISTIC SCENES IN SPAIN

1. Salamanca showing the 12th century cathedral and the Roman bridge over the Tormes River. 2. Tower of the Clavero in Salamanca. 3. Bull-fighting: the Spanish

national sport. 4. Barcelona harbor from Montjuich. 5. Majorca, Balearic Islands. Terraced hillside and village. 6. Unfinished cathedral of the Holy Family, Barcelona.

SPAIN

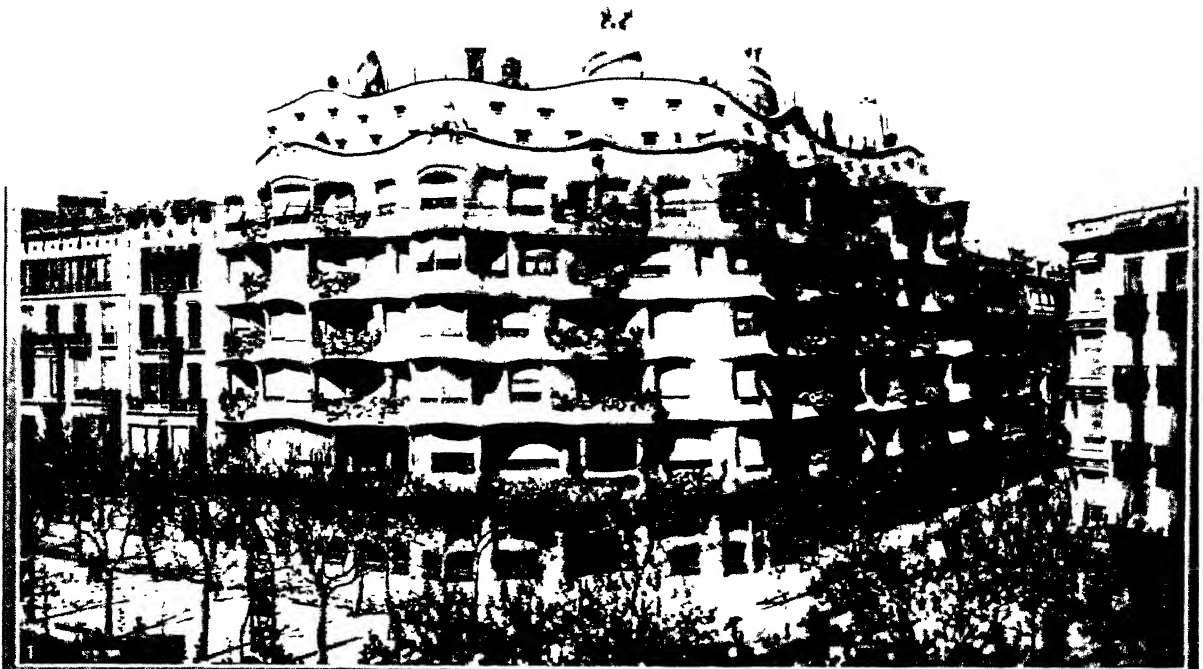


COURTESY SPANISH TOURIST INFORMATION OFFICE

CATHEDRALS AND CASTLES OF OLD SPAIN

1. Bell tower of the Mosque in Córdoba built by the Moors, now the Cathedral.
2. Torre del Infantado, a feudal castle in the village of Potes
3. Doorway of the Old Cathedral in Salamanca.
4. Moorish arch in the Alhambra, Granada.

SPAIN



COURTESY SPANISH TOURIST INFORMATION OFFICE

MEDIEVAL AND MODERN SPAIN

1. A modern apartment house in Barcelona.
2. Toledo as seen from across the Tagus, showing the Alcázar and the Alcántara bridge.

SPAIN



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SPAIN'S THREE LARGEST CITIES

1. Seville, from the suburb Triana, showing Giralda tower and Cathedral. 2. National Institute of Hygiene, Madrid. 3. Paseo de San Juan, Barcelona, looking toward Triumphal Arch. Court house on the right. 4. Royal Palace in Madrid.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

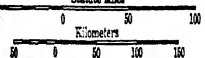
PORTUGAL DISTRICTS

- 1 Aveiro
- 2 Beja
- 3 Braga
- 4 Bragança
- 5 Castelo Branco
- 6 Coimbra
- 7 Évora
- 8 Faro
- 9 Guarda
- 10 Leiria
- 11 Lisbon
- 12 Portalegre
- 13 Porto
- 14 Santarém
- 15 Viana do Castelo
- 16 Vila Real
- 17 Viseu

BAY OF BISCAY

**RAND McNALLY
POPULAR MAP OF
SPAIN AND PORTUGAL**

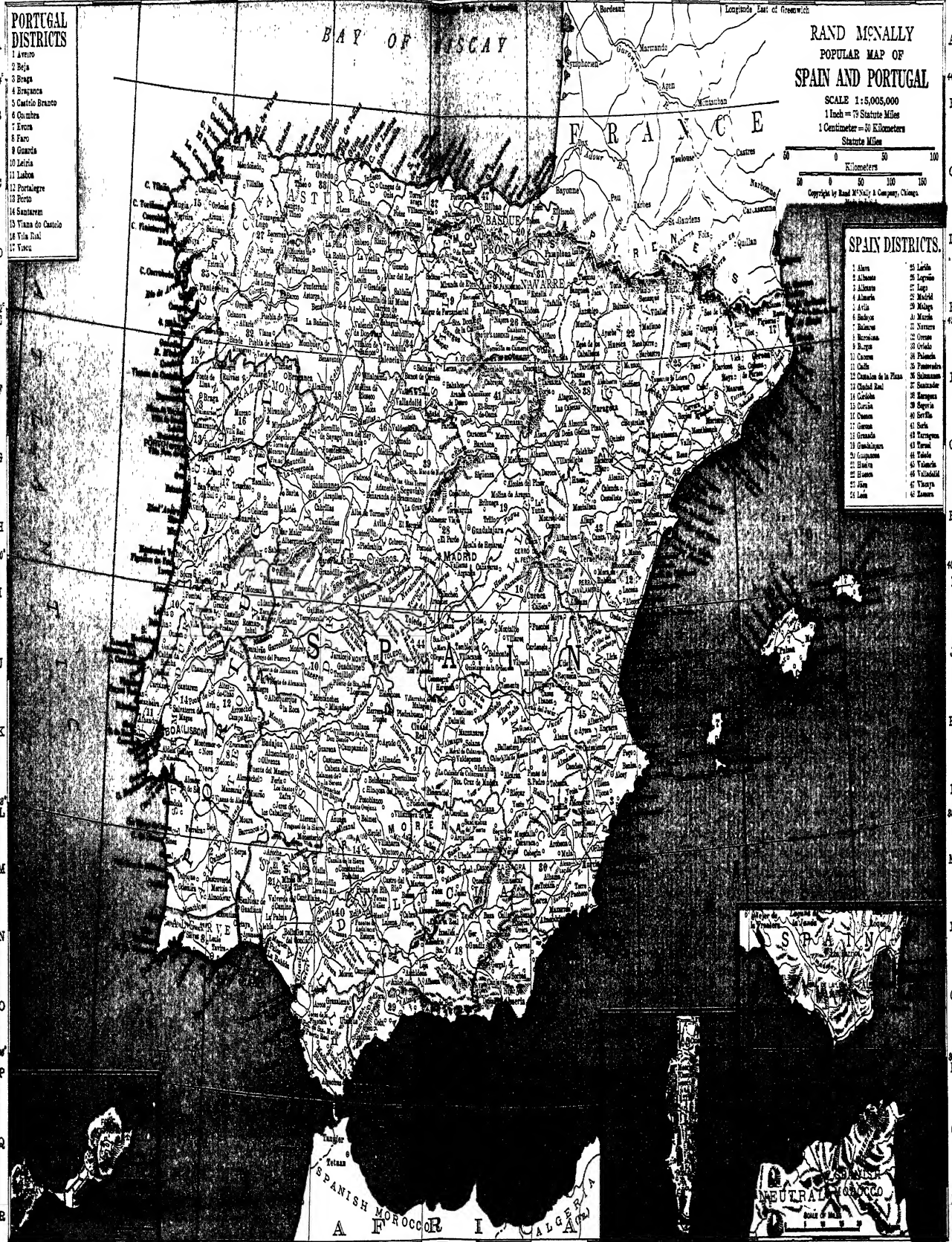
SCALE 1:5,005,000
1 Inch = 75 Statute Miles
1 Centimeter = 30 Kilometers
Statute Miles



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SPAIN DISTRICTS

- 1 Álava
- 2 Albacete
- 3 Almería
- 4 Aragon
- 5 Asturias
- 6 Badajoz
- 7 Baleares
- 8 Barcelona
- 9 Burgos
- 10 Cantabria
- 11 Castellón
- 12 Cataluña de la Plaza
- 13 Ciudad Real
- 14 Córdoba
- 15 Gerona
- 16 Granada
- 17 Guadalupe
- 18 Huesca
- 19 Jaén
- 20 La Rioja
- 21 León
- 22 Lugo
- 23 Madrid
- 24 Málaga
- 25 Murcia
- 26 Navarra
- 27 Orense
- 28 Oviedo
- 29 Palencia
- 30 Pamplona
- 31 Salamanca
- 32 San Sebastián
- 33 Segovia
- 34 Sevilla
- 35 Tarragona
- 36 Teruel
- 37 Toledo
- 38 Valencia
- 39 Valladolid
- 40 Vizcaya
- 41 Zamora



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

the Sierra Nevada and on the north and west coasts is from 25 to 30 in. but on the tableland it is only 10 in. Winter is the rainy season. In the southeast, at Murcia and Valencia, it is almost perpetual spring, but in the south and southwest around Seville, the climate is almost tropical.

Flora and Fauna. The vegetation on the Spanish landscape changes abruptly. The wooded north with its oaks, chestnuts, beeches, birches, hazels, limes, maples and pines is set over against the Mediterranean zone with its evergreen oaks, wild olive, carob and white pines. From the plains of Granada to the olive groves of Cordoba, from the wheat fields of Campos to the meadows of Asturias, from the cypresses of Generalife to the orange plantations of Valencia and Alicante, the maize fields of Galicia and the vineyards of La Mancha, La Rioja and Jerez, the country is full of changing scenery. Fruit is abundant—apples, pears, cherries, plums, peaches, apricots, dates, figs, oranges and citrons as well as bananas are among the most plentiful. The culture of the vine and the nut is general, both forming a large domestic and foreign trade.

Agriculture. Of the wild fauna, the only large animals are the wolf, lynx, bear and chamois which may still be found occasionally in the mountains. The chameleon can be found in the vicinity of Cadiz and numerous apes haunt the Rock of Gibraltar. Of the fisheries on the coast, mention should be made of the sardines of Galicia and the tunnies of the southwestern shores. In Spain there are 505 factories, employing about 24,000 workers engaged in the preparation of sardines and various fish.

The country is chiefly agricultural and pastoral, the productive area being about 113,987,500 acres, although all of this is not under direct cultivation. The area devoted to pasture and mountains occupies 60,138,876 acres. The division and production of the land, according to the 1929 returns, show that 3,431,717 acres under vines yield ordinary red and white wines to the extent of 649,935,390 gals. At this time there were 23,627,745 orange and 810,765 lemon trees, yielding a value of 277,062,129 pesetas for oranges and 14,448,569 for lemons. About 151,310 acres were planted with sugar beets and 6,615 with cane sugar. Potatoes occupied 910,400 acres; onions, 55,605; olive trees, 4,489,963; almond trees, 287,790; and hazelnut trees, 19,182 acres. Spain began the cultivation of tobacco in the 1920's, about 7,000 acres being used for this crop. The division of cereal acreage shows that wheat occupies 11,852,725 acres; barley, 4,487,555; oats, 1,838,730; rye, 1,518,830 acres. The number of farm animals in 1929 was estimated at 589,306 horses, 1,153,874 mules, 1,006,050 asses, 3,659,639 cows, 19,370,443 sheep, 4,524,954 goats and 4,773,366 pigs. Some of the horses, which have descended from breeds introduced by the Moors, are celebrated throughout Europe.

Minerals. The mineral resources of the country are many. Iron is found in the provinces of Vizcaya, Santander, Oviedo, Navarra, Huelva and Seville.

Copper is found in Seville, Cordoba, and Huelva; coal in Oviedo, León, Gerona, Valencia and Cordoba; zinc in Santander, Murcia, Guipúzcoa and Vizcaya; cobalt in Oviedo, which also has smaller quantities of manganese, lead, salt, sulphur, quicksilver and phosphates. The total value of the mineral output in 1929 was 485,062,461 pesetas at the pit mouth, there being 2,271 productive mining concessions, employing 143,421 men, 4,468 women and 15,478 boys and girls under 18 years of age.

Manufactures and Commerce. The 1928 returns on pig iron production show 556,974 metric tons, and on steel, 772,042 tons. During the same year, 1,542,324 metric tons of cement were produced from 25 cement factories.

A 1927 report shows 4,492 alcohol plants producing brandy and spirits to the extent of 94,253,999 liters and 46 breweries yielding 51,821,645 liters of beer. The cotton goods industry is principally in Catalonia, but in the whole of Spain in 1930 there was a total of 60,083 looms, and in the woolen factories, 6,700 looms with 274,800 spindles. There were also 160 paper mills and 29 glass factories.

The principal exports for 1929 with their peseta value were stone, minerals, glass and pottery, 176,708,995 pesetas; metals, 157,503,003 pesetas; timber and its manufactures, 202,752,171 pesetas; alimentary goods, including grain, sugar, wine, the latter representing about 20% of this commerce, 1,192,905,152 pesetas. The imports of the country from the United States represent value to the amount of 435,785 pesetas, which is larger than from any other country.

Beginning in the '20s the foreign tourist industry has become an important feature in the country's financial prosperity. Large numbers of visitors flock to Seville for Holy Week, to Valencia for the Fallas de San Jose, and later to the Battle of Flowers, or to Saragossa and Granada for unique folk festivals held in those cities. San Sebastian and Santander have become famous winter resorts and known to the travelers of all nations. In the summer and winter the principal cities of the country are thronged with tourists from other lands, some to MADRID to see El Escorial and the Prado galleries, some to CORDOBA to see the famous mosque-cathedral, some to SEVILLE to see the Giralda tower and the alleged tomb of Columbus, some to Granada to see the ALHAMBRA, some to BARCELONA to see the cathedral, and others to visit the Rock of GIBRALTAR.

Transportation. During the late '20s the highways of Spain have been immensely improved. In 1930, 2,600 km. of new motor roads were built and opened. The total length of the roads is about 55,000 mi. There are now no better roads in all Europe. The 10,138 mi. of railroads are divided into two different gauges, 7,331 mi. follow the Spanish-Portuguese gauge about 10 in. under the standard gauge, and the balance varies. This makes necessary a change of cars for passengers and goods at the French border. The rail companies are privately owned but most of them are subsidized by the state. There are a num-

ber of bus services, most all of them from the smaller villages to the railroad station. Concerning other forms of internal communication, it can be said that in 1928, the post-office carried on inland routes 587,871,096 pieces of mail and in the foreign service, 120,997,384. The total receipts of the 10,558 post-offices amounted to 91,538,048 pesetas as against an expenditure of 61,904,300 pesetas. The telegraph offices, numbering 2,904, sent and received in 1926 a total of 22,626,005 interior messages, despatched 1,220,932 and received 1,283,552 international messages, with transit messages numbering 399,543. In 1924, the entire telephone system was taken over by the International Telephone and Telegraph Corporation of New York and since then telephones have been rapidly installed all over the country. In the first four years of American operation, over 2,000 exchanges were placed in operation. The air services are controlled by a private corporation, which receives a state subsidy of over 1,000,000 pesetas annually.

Finance. In matters of finance and banking, the government, until the republic, participated in the profits of the Bank of Spain up to certain limits. There are about 1,750,000 savings bank accounts holding 1,608,431,540 pesetas. The total number of depositors in all banks and savings institutions, including the savings banks of the post-offices, on Dec. 31, 1929 numbered 3,091,667. The peseta of 100 centimos is the current money unit, which before the World War had the value of the franc. Gold coins in use but not in circulation are the 100, 50 and 25 peseta pieces, while the silver coins range in value from 5, 2, 1 pesetas and 50 centimos pieces. The decline in the peseta brought about an increase of paper circulation to 6,000,000 pesetas, the full amount allowed by law, as against 4,800,000,000, the figure before the republic was established.

Army and Navy. The establishment of the republic brought about changes in the army and navy and lessened their former influence. Up till then service had been compulsory, the total term of service in the army being for 18 years, the active service being normally for about two years. The strength of the army in 1929 was 14,965 officers, 120,000 men, with 32,500 gendarmerie in addition. In 1930 the number of recruits called to the colors numbered 45,076. In the army reserve there is a force of about 90,000. The republic has abolished the military regions into which the country was divided, and mobilization centers have been reduced from 70 to 16. In the navy there were 1,741 officers, with 365 in the reserve, 16,000 sailors and 3,000 marines. In 1931 the navy possessed two battleships, five cruisers, six flotilla leaders, six destroyers, 22 torpedo boats, 14 gun boats and 16 submarines.

Religion and Education. The national religion of Spain, until the republic was established, was the Catholic, but one of the first proclamations stated that under the new régime "all religions may be professed privately and publicly." On Oct. 13, 1931 the age-old tie between Church and State in Spain was declared

at an end. The same day the Jesuit order was expelled from the country and religious orders were forbidden to engage in commerce and industry or in teaching. The republic has made compulsory primary education one of its first measures, for according to the census of 1920, the latest dealing with this question, only 46% of the population could both read and write, and 45% could do neither. The public schools since 1902 have been supported by the state, and most of the children are educated free. In 1928 there were 23,690 public and 6,000 private schools with an aggregate number of 3,200,000 pupils. In addition to these, some 65 secondary schools had 77,347 pupils. Some 39,719 students, of whom 3,285 were women, were enrolled at the 11 universities at Barcelona, Granada, Madrid, Murcia, Oviedo, Salamanca, Santiago, Seville, Valencia, Valladolid and Saragossa. The University of Seville maintains a medical and science faculty at Cadiz and a branch in the Canary Islands. In 1928, the total sum spent on education and the fine arts was 159,346,394 pesetas.

Government. The Republic of Spain was proclaimed on Apr. 14, 1931, and stood the test of a national election on June 28 of the same year, the first held since Primo de Rivera set up a dictatorship eight years before. A coalition government was returned of Conservative Republicans and Right Wing Socialists, the largest number of deputies being Socialists. All titles of nobility as official honors were set aside, affecting 97 dukes, 1,310 marquesses, 900 counts, 1,400 viscounts, 148 barons and 359 grandees. The constitution as planned aims to include the autonomy of the provinces, the abolition of the state religion and the expulsion of all religious orders, compulsory primary education, the enactment of divorce legislation, the socialization of many industries and sex equality. Members of the chamber of deputies may be both men and women of 23 years of age and over, who are to be elected by universal suffrage for a term of five years. The President is to be elected by a direct popular vote and serve for six years.

Population and Language. According to the official estimate of population made at the close of 1929, the total for the entire country was 22,760,854, which included the Basques in the north, numbering about 400,000, and the four Catalan provinces with their population of 2,475,793. The nine largest cities had a population as follows: Madrid, 825,471; Valencia, 272,129; Seville, 217,924; Malaga, 160,228; Saragossa, 157,399; Murcia, 156,485; Bilbao, 160,501, and Granada, 109,001. In 1931 Barcelona became the largest city, with a population of over 900,000.

The peninsula of Spain is inhabited generally by dark, long-headed types of people. The Moors who entered Europe in 711 considerably influenced the customs and habits of the Spaniards, but the language remains primarily Castilian, with various dialects in different regions. *See also* BASQUE; CATALAN; GALICIAN; SPANISH.

SPAIN, HISTORY OF. There are five main periods in the history of Spain: the early days, when the

foundations were laid for the creation of a Spanish people; the era of the Roman Empire, when an orderly civilization was established; the long dominance in the peninsula of the Moslem peoples, when important new racial elements were introduced; the great epoch of Spain's leadership in world affairs, from the time of Ferdinand and Isabella through the reign of Philip II, and in certain respects even beyond his time; and the groping efforts in the more recent past of a now second-rate state.

Early History. The salient fact about the Iberians, who were in Spain at the dawn of history, is that they were a brave, independent and individualistic people, possessing traits which ever since have been a fundamental part of Spanish character. Other peoples who later came to Spain began soon to manifest the same traits, if they did not already have them. The Phoenicians were traditionally the first alien people to enter Iberian Spain, getting a foothold in the peninsula as early as the 11th century, B.C. Later there came the Carthaginians and Greeks and the great wave of the Celtic conquest. Eventually Spain served as a battleground for Rome and Carthage in the course of the Second Punic War. Rome was the victor, and with the abandonment of the peninsula by the Carthaginians in 206 B.C., the long period of Roman control began.

Roman Control. From 206 B.C. to 409 A.D., more than six centuries, the Iberian Peninsula was under the dominance of Rome. Without some such influence as that of Rome there never would have been a modern Spain, for it was the organizing genius of Rome which gave to the peoples of the peninsula their first real touch of civilization. It was Rome who to a great extent transformed these peoples, grafting upon them new institutions of Latin type, even the Latin tongue. Rome it was who gave them law and administration, employing road making and city building as well as armies for the means to obtain their ends. And from Rome came a new social order, which later chose Christianity as the main axis of its life. Introduced at least as early as the 2nd century, the Christian faith made rapid progress, and at length captured the field.

Germanic Invasions. The Roman influences became one of the permanent factors in the history of Spain. Even the political dominances of Rome did not pass away in 409; but it was in that year that the first of the Germanic invasions occurred which were soon to bring about the overthrow of Rome's power in the peninsula. Most important of the Germanic invaders, though not the first, were the Visigoths, who ruled the country much of the time in a period of approximately three centuries, from 409 to 713. These years were in the main a time of chaos, marking a setback from the orderly life of the Roman Empire. The northern peoples did, however, reinvigorate the peninsula, primarily through compelling a return to a more primitive mode of life. In the end, very few traces of their civilization remained, while the Ibero-Roman traits lived on.

Beginning of Moslem Dominance. Taking advantage of the bickerings in the feeble Visigothic kingdom of Spain, a Moslem invasion began in 711 which was to overrun the peninsula in the course of two years and even reach far into the Frankish lands beyond the Pyrenees. By 740, however, the Moslem forces had recrossed the mountains, and thenceforth confined their efforts in the main to the region of the peninsula. For five centuries the Moslem peoples were easily the principal factor in the life of what are now Spain and Portugal. For nearly three centuries more they dominated southern Spain, the eventual recruiting ground for the Spanish conquerors of the Americas. Even after the fall of the last of the Moslem kingdoms in 1492, the problem of assimilating the Moslem populations remained a factor for more than another century. It was natural under the circumstances that there should have been a profound renovation of Spanish life as a result of the long period of influence of the Moslem peoples, and, indeed, the Moslem conquest was the basis for that differentiation of the Spaniards from the other peoples of western Europe which has so often been remarked in modern times. The familiar phrase, "Africa begins at the Pyrenees," calls attention to that differentiation far more than it implies any likeness between Spaniards and the peoples of North Africa.

The most numerous element among the conquerors were the Berbers of northwest Africa. They were a somewhat rude and uncultivated, but intensely brave and individualistic, people, not unlike the old Celtiberian populations of the peninsula. As the invasion of the Moors, one branch of the Berbers, in 1145 turned out to be the last one from Africa to meet with success, it has become customary to apply their name to the whole of the Moslem era, which would seem to be grossly inaccurate, not only because they were the last and perhaps the least important of the Berber races to overwhelm the peninsula, but also because the Berbers themselves were far less important in the effect they produced than the numerically inferior but infinitely more influential Arabic masters of the early invasions. It was the Arab who marked the Spanish peoples with his traits in such fashion as to make them differ so greatly from other western Europeans. If one may "scratch a Russian to find a Tartar," one may employ the same process in Spain to reveal an Arab.

Of all the independent, individualistic peoples of the world, the Arabs of the Arabian Desert were, are, and perhaps ever shall be the world's leading exemplars. Not a naturally pious people, they seemed to be most unpromising agents for the propagation of a new religion which one of their number, the Arab Mahomet, gave to them early in the 7th century. Making an appeal to them, however, through their love of fighting and zest for plunder, the successors of Mahomet saved the religion of the prophet by embarking upon a great world conquest. In less than a hundred years the Moslem arms carried all before them in a most astonishing conquest reach-

ing at its greatest limits from India by way of north Africa to southern France. The conquered peoples not infrequently became zealous Mahometans, in this respect far surpassing the Arabs themselves. Especially was this true of the Berbers. The conquest of north Africa proved to be the most difficult of any the Arabs undertook; but when after many years the Berbers submitted they had already become fanatical Mohammedans. When the Moslem invasions swept over the Iberian peninsula it was the Arab who ruled the country and set the standard for life within the conquered regions. And it was an Arabic culture, greatly influenced to be sure by the Byzantine civilization of the lands taken from the Eastern Roman Empire, which at first overlay the old Ibero-Roman customs and at length became a component part of what now stands forth as the modern Spaniard.

Internal Dissension. Arabic rule in the peninsula, if comparable in length of time to that of the Romans, was quite dissimilar in other respects. The organizing, cooperative spirit of the Romans made for peace and good order, but the individualistic Arab, restless of control, was ready for war on the slightest pretext, whether against a foreign foe or in some conflict within the Moslem state. The political history of Moslem Spain is the story of great kingdoms being formed, only to crumble rapidly, primarily as a result of internal dissension, and then of yet new great kingdoms rising from the ashes of the old, with a quickly ensuing break-up into numerous petty states, or *taifas* as they were called. The first great surge of the Moslem conquest reached far into modern France. It is often said that this was beaten back as a result of a victory by a Frankish army under Charles Martel at the battle of Tours in 732. In fact, it was not this battle which caused the retirement of the invaders, but a great Berber revolt against the Arabs in 740, eight years after the allegedly decisive battle of Tours.

Incessant conflicts between Arabs and Berbers in Spain were only one of a number of factors leading to the eventual disintegration of Moslem Spain. Arabs fought Arabs, for though it is true that an Arab despised all who were not Arabs, he also despised and warred with all other Arabs who did not belong to his particular tribe. One of the most serious elements in internal strife arose from conflicts between the conquered populations and their less numerous conquerors. Of the former the most important were the converts from Christianity to Mohammedanism, or Renegades as they were called. Constituting the great majority of the population of Moslem Spain this group was indeed faithful to the teachings of Mahomet, but bitterly hostile to the Arabs. Many a civil war was fought in consequence. Less numerous, but also a factor making for dissension, were the Mozarabes, or Christians living within Moslem realms. Moslem Spain had its heresies, too, and the wars of Sunnites against Shiites or of other sects within the Moslem faith were a factor weaken-

ing the central control. And finally there were the Christians just beyond the borders of the Moslem realms, ready to take advantage of such openings as might be afforded them by the domestic difficulties of their normally more powerful neighbors.

Disintegration of Moslem State. The first great resurgence of Moslem power, after the initial conquest, came with the reign of Abd-er-Rahman I (755-788). He reduced most of the peninsula again. There followed more than a century of disorder, until the appearance of Abd-er-Rahman III (912-961), who was by far the most important ruler of Moslem Spain. Under him Spain was easily the greatest state in Europe, and in western Europe it was also the center of the highest culture. This was the last great moment of Arabic control in Spain, however. Shortly afterward the Moslem kingdom, which Abd-er-Rahman III had converted into the caliphate of Cordova, to signify its leadership in the Moslem world, fell into the hands of a military usurper, Almanzor (d. 1002), and from this time forward, despite Almanzor's many brilliant victories against the Christians of the north, the Moslem state rapidly disintegrated. In 1031 the last ruler of the line which had established the caliphate was deposed, and the caliphate came to an end. There followed an era of *taifa* states, during which much ground was lost to the Christian kingdoms in the north. Some of this territory was regained when another Berber invasion came out of Africa to reunite Moslem Spain. The conquerors this time were the Almoravides, whose period of power covered the years 1086 to 1125. In 1125 another group of Berbers, the Almohades or Moors, rose against the Almoravides in Africa, and after a long war they overwhelmed their erstwhile rulers. Meanwhile a new era of *taifas* had developed in Spain; but in 1145 the Almohades entered the peninsula, and reduced the *taifa* states, to remain in power until 1212, when they were at length overthrown by the Christians of the north in the great battle of Las Navas de Tolosa.

Christian Conquests. The Moslem conquest never completely overran the peninsula; from the first, there were several Christian nuclei in the mountains of the north. Traditionally the reconquest began in 718, when Pelayo defeated a Moslem army in the Battle of Covadonga. In point of fact, however, there was little effective action against the Moslem power until the 13th century. In moments of turmoil within Moslem Spain, the Christian states of the north expanded their territories, only to yield ground at other times. Gradually, however, two main centers of Christian strength developed. One of these started in Asturias, and advanced by way of Leon to become the kingdom of Castile. Galicia, the Basque provinces, Navarre, and for a time Portugal were a part of this stream. In the 12th century Portugal established itself as a separate kingdom, and withdrew from the current of Spanish history. In northeastern Spain the originally separate states of Aragon and Catalonia were united in the 12th century, to become

the kingdom of Aragon. Both Castile and Aragon were very backward by comparison with Moslem Spain, and even in their political life were somewhat reminiscent of the chaos of Visigothic days. It was not until the 13th century that they were ready to emerge from the obscurity and unimportance which hitherto had characterized them; but from this time forward the forces which had been making crudely for the unity of Christian Spain moved at an accelerated pace. One of these factors was the appearance in the 13th century of a Christian crusading spirit as against the Moslems. Down to that century Christians fought Christians quite as much as they fought Moslems. Ferdinand III (1217-52) was Castile's leader in the Christian crusade, carrying the conquest into Andalusia in southern Spain. An even greater military figure, perhaps, was James I (1213-76) of Aragon. He conquered the Balearic Islands and Valencia for himself and even Murcia on behalf of Castile. By the time of his death all that remained of the once great Moslem state was a single *taija*, the kingdom of Granada.

For the next two centuries the problem of Christian Spain was one of unity. Many obstacles had to be overcome before long separated regions, inhabited by exceedingly individualistic peoples, could accept a single rule. The problem, indeed, was quite as much of the intra-state variety as it was inter-state. For example, a turbulent and powerful nobility had to be subjected to the royal authority. It was necessary to bring about some approximation in the laws and speech of different regions. And eventually the different kingdoms had to be united. The culminating point in this movement for national unity was the reign of the Catholic Sovereigns, Ferdinand and Isabella.

Ferdinand and Isabella. In 1469 Isabella, heir to the throne of Castile, married Ferdinand, the heir of the king of Aragon. Isabella in 1474 and Ferdinand in 1479 succeeded to their respective thrones, and soon transformed what was intended to be merely a union of two crowns into an effective single kingdom. The unity of Spain was the greatest achievement of Ferdinand and Isabella; but several incidents in that program demand mention. They suppressed the nobility, destroyed the last vestiges of Moslem power by the conquest of Granada in 1492, and began an enforced conversion of the non-Christian elements in the peninsula. Historically the greatest event of their reign was the discovery of America in 1492. At the same time Spain plunged determinedly into the maelstrom of European politics which was later to engulf her and reduce her to the rank of a second-rate power. For the moment, however, Spain's policy seemed to be a success, as Ferdinand made conquest after conquest in Italy and humbled the King of France.

The Greatness of Spain. With the accession of the son of the daughter of Ferdinand and Isabella, Charles I, 1516-56, better known by his title of Charles V of the Holy Roman Empire, Spain advanced rapid-

ly to become the greatest of European states. Under Charles and Philip II, 1556-98, Spain was the principal political and military power of Europe and the defender of the Catholic faith against the inroads of Protestantism. They and their successors effected the conquest of the Americas, at first through the spectacular expeditions of the *conquistadores*, or conquerors, of the first half of the 16th century, and later by the slow-going but more thorough method of settlement of the conquered regions, making them Spanish in manner of life as well as politically. The 16th and 17th centuries also marked the highest point in the history of Spanish achievement in science, literature and art. If the 17th is ordinarily considered Spain's "golden century," because it was then that great literary figures like Cervantes, Lope de Vega and Calderon, and great painters like El Greco, Velázquez, and Murillo produced their works, the 16th was the century of outstanding importance in most other phases of intellectual brilliancy. New points of view and new methods were employed by Spaniards in philosophy, jurisprudence, economics and history, and noteworthy contributions were made in the fields of natural science, geography, cartography, mathematics, the physical sciences and medicine. The vast new lands in the Americas furnished part of the material for Spanish innovations in science.

Charles I belonged to the House of Habsburg, or Austria, on his father's side, and fell heir to dominions in Burgundy, the Low Countries and Austria, as well as to those in Spain, Italy and the Americas. Thus a position inviting an attempt at dominance in European affairs was virtually thrust upon him, which became only the more marked when in 1519 he became Holy Roman Emperor. As his empire was widely scattered and lacking in homogeneity, however, his power was challenged by the Protestant princes of Germany, by the Turks and the Moslems of North Africa, by France, and even by the popes themselves in their temporal capacity as rulers of the papal dominions in Italy. Spain, with the backlog of the treasure from the Americas, had to bear the chief burden of these almost incessant conflicts; but the effort was too much for her. Charles not only failed to stamp out Protestantism but also was unable to impose his will on western Europe generally.

Philip II continued his father's policies, but found new enemies in England and the Protestant Netherlands. Like his father, Philip was an ardent defender of Catholicism; indeed, the triumph of that faith was so outstandingly a principal aim of his life that the name of Philip has always been associated with the ideal of an uncompromising adherence to Catholicism and intolerance of heretical deviations therefrom. This did not by any means imply any temporal subjection of Spain to the popes, with whom Philip warred on several occasions, as his father had done. Philip in fact tried to control the papacy, without interfering with the Catholic faith, but in the end failed in his endeavors, although he obtained virtual domi-

nance over the Church in its ecclesiastical management in Spain and the Americas. In 1580 Philip acquired the crown of Portugal; but in a later reign, in 1640, Portugal began a war for independence which proved to be successful.

Decline of Spanish Power. Seemingly the great power in Europe, Spain had exhausted her energies in the fruitless effort to sustain the ambitious policies of Charles and Philip. The turning point came in 1588, when Philip's great Armada was overwhelmingly defeated in the attempt for a Spanish descent upon England. Thereafter Spain's political and military leadership in Europe were merely a surface veneer, while the forces of disintegration were at work to destroy the foundations of Spanish power. There were three more kings of the House of Austria: Philip III, 1598-1621, Philip IV, 1621-65, and Charles II, 1665-1700, all of them feeble shadows of their great predecessors of the 16th century, and the last of the line a sickly idiot who took 35 years to die. As France now emerged as the leading country of Europe, Spain sank to almost unbelievably low depths, in the various phases of her ordinary life as well as in political importance. The impetus of Spain's great achievements in the 16th century carried her along to yet loftier heights in some manifestations of her inner life, notably in art and literature; but even in these characteristics the decline was rapid and very nearly complete by the end of the reign of Charles II.

Italy and the Low Countries continued to absorb Spanish effort, involving the country in many wars and frequent defeat. Within the peninsula the individualism of Spanish character began to reassert itself and become a factor in political affairs. Not only did Portugal regain her independence; but other regions also fought the central government, notably Catalonia. Though unsuccessful in her efforts at separation from Spain, Catalonia from that time forward down to the present day was to be a kind of Spanish Ireland, conscious of her racial difference from the metropolis and quite as often in the ranks of the opposition as on the Spanish side in the wars of Spain. As an index of the general Spanish decline it may be mentioned that the population was almost certainly much less at the end of the 17th century than it was at the start. According to some estimates the decline amounted to as much as a third.

Bourbon Dynasty. At the moment when Charles II died, French influence was in the ascendant. The throne of the childless last king of the House of Austria passed over to a prince of the French House of Bourbon. From then until 1931 a Bourbon was always king of Spain, except for three brief intervals in the 19th century. The more than two centuries of their rule divide naturally into two periods: the first, from 1700 to 1808, the era of absolute rule; and the second, from 1808 to 1931, the age of the liberal monarchy. Most of the 18th century was a time of recovery from the extreme degradation of the last days of the House of Austria. The movement had its beginnings under Philip V, 1700-46; gathered head-

way in the peaceful reign of Ferdinand VI, 1746-59, and reached its peak under Charles III, 1759-88, greatest of the Spanish Bourbons. The mainspring of Spanish action was the necessity for defensive measures as against England, now become the most powerful of European states. Sweeping reforms were made in the social, political and economic life of Spain in order to provide the sinews of war, and they also revived the nearly defunct Spanish state until Spain had to be reckoned with once again as an important figure in European affairs, if no longer in first place. The reforms were of the typical character of that age of the "Enlightened Despotism," when monarchs, with the aid of able ministers, sought improvement for their people but not by them. Just at the moment when, with the defeat of England in the American Revolution, in which Spain participated with France against England, it seemed that Spain was once more a first rank power, she was toppled from her high place by circumstances beyond her control.

During most of the 18th century the absolute Bourbon monarchy of France had been an ally of Spain. The outbreak of the French Revolution in 1789, with its anti-monarchical doctrines, very soon destroyed the value of this alliance, and presently replaced it with an era of open hostility between France and Spain. These events took place in the reign of the weak Charles IV, 1788-1808, culminating in the time of the Napoleonic Empire. In 1808 Charles IV and his son Ferdinand were lured to Bayonne in southern France and seized by Napoleon. There followed an invasion of the peninsula by the French and a temporary overthrow of the Spanish Bourbons, with Joseph Bonaparte, 1808-14, brother of Napoleon, on the throne of Spain.

Although French armies overran most of Spain, the Spanish people never accepted French rule. An uprising began almost at once. In the absence of the legitimate king, various committees, or *juntas*, were organized to carry on the war and manage such affairs as were within the control of the anti-Napoleonic Spanish state. Eventually there was a single central *junta*; but in 1810 its place was taken by the Cortes, or Spanish congress of deputies. The Cortes did more than fight the war against Napoleon. It declared for a radical change in Spanish government, and enacted the Constitution of 1812, which provided that henceforth the Cortes was to be the dominant element in a limited monarchy, with a king who was to reign but not rule. Thus a platform was formulated which was to be the central theme of Spanish political history for many years. Meanwhile the French were driven out of Spain, with the aid of the English, and Ferdinand, now Ferdinand VII, 1814-33, became king. This victory was offset, however, by a great loss in another quarter. In 1810 the peoples of Spanish America began the series of wars against the mother country which were to last until 1824 and result in the independence of Spanish America from Spain. Cuba, Porto Rico and the Philippines, of the once great Spanish overseas em-

pire, were retained, but these too were lost in the war of 1898 with the United States.

The 19th century was an age of experiment in liberalism by a people whose excessive individualism made democratic institutions difficult of success. Laws and constitutions now became democratic and liberal; but the old absolutism continued in fact. Usually, however, the monarchs were in the background, intent upon saving the crown, while the government was in charge of irresponsible ministers. Theoretically they represented the Cortes, whose members were elected by the people, but in fact the ministers manipulated elections and controlled the Cortes. They ruled, subject to two possible checks. The king might, if he dared, reassume his place at the top. And the army, which had been the servant of the monarchy in previous centuries, might now, and often did, refuse to sanction the actions of the ministers, and the ministers would fall. Spanish ministerial control reached such a point that in the closing years of the 19th century and in the early part of the 20th the Liberal and Conservative parties alternated in power by agreement. Thus the Constitution was observed and peace maintained.

It was natural that there should have been much dissatisfaction with existing Spanish governments, which were often as corrupt and ineffective in action as they were a misnomer from the standpoint of liberalism. When the successor of Ferdinand, Isabella II, 1833-68, was overthrown, an attempt was made to establish a new reigning family. Amadeo of Savoy was prevailed upon to accept the throne, but resigned in 1873. Then for a moment Spain became a republic. The times were not propitious, however, and in the next year the Bourbons were back in the saddle. Alfonso XII, 1874-85, died shortly before the queen gave birth to a son, who therefore became king from the moment of his birth in 1886. This was Alfonso XIII, titular monarch from that time forth until the establishment of the new Spanish republic in 1931. His reign was not blessed with any great political or international success. On the contrary the normal ills of Spanish life were complicated by the development of radicalism and the growth of the home rule idea in different parts of the peninsula, but especially in Catalonia. At length, in 1923, Alfonso disavowed the existing Government, and in conjunction with the army created the dictatorship of Gen. Rivera, later succeeded by Gen. Berenguer. Meanwhile sentiment in favor of a republic had for years been gathering strength in Spain, especially in Catalonia and Madrid. Efforts to check it were without avail. Unable any longer to withstand the demands for a change from the prevailing dictatorship, the Government at length consented to the holding of elections early in 1931. The results were so strongly pro-republican that Alfonso left the country. The Spanish Republic was thereupon proclaimed, with NICETO ALCALA ZAMORA, President. C. E. C.

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SPAIN, TREATY WITH, Oct. 27, 1795, a treaty between the United States and Spain concluded by Thomas Pinckney, special envoy from the United States to Spain. This guaranteed to the United States the free navigation of the Mississippi to its mouth, and the use of the wharves and warehouses of New Orleans for a three-year period, after which New Orleans, or some other point on the lower Mississippi, was to be confirmed as a place of deposit; provided that Spain indemnify the United States for losses sustained by the unlawful capture of American vessels by Spain in that country's late war with France, and fixed the 31st parallel north latitude as the boundary of West Florida. The treaty was highly popular in the West.

SPAIN, TREATY WITH, Feb. 22, 1819, a treaty between the United States and Spain. The United States, occupying West Florida, demanded that Spain sell East Florida, for the "elimination of international nuisances." The invasion of East Florida by Gen. Jackson, in the SEMINOLE WAR, and the fact that his assumptions of extraordinary authority therein went unrebuked by the National Administration, strained the already unfriendly relations between Spain and the United States. The French minister at Washington, De Neuville, mediating between Secretary of State JOHN QUINCY ADAMS and the Spanish minister, De Onis, suggested that Spain yield Florida and the United States relinquish its claim that Texas was acquired as a part of the LOUISIANA PURCHASE. Upon this compromise the treaty was effected, the United States accepting the Sabine as the lower western boundary of Louisiana and securing Florida for \$5,000,000, the entire amount of which was to be applied to the settlement of claims preferred by American citizens against Spain for spoliations committed by Spanish ships of war upon American commerce. The western boundary of Louisiana was defined from the Sabine to the 42nd parallel.

SPALATO, the old Aspalathos, Serbo-Croatian Split, belonging to Venice from 1420 to 1797, since 1920 to YUGOSLAVIA. Economic center of Dalmatia, picturesquely framed by high mountains, it lies in a fruitful region on a peninsula. The city is rich in ancient buildings. The old city is mostly built into the large quadrangles of the palace of the Emperor Diocletian, who died in 313. The peristyle of the palace forms the cathedral square. The cathedral, Diocletian's mausoleum, is a handsome round building surrounded by columns. Near it is the baptistry, with a lovely campanile. It is the seat of a Roman Catholic bishop, has advanced schools, a museum, trade in wine, olive oil, fruit and grain, and manufactures a variety of commodities. Pop. 1931, 43,808.

SPALDING, ALBERT (1888-), American violinist, was born at Chicago, Ill., Aug. 15, 1888. He studied with Jean Buitrago in New York, Ulpiano Chiti in Florence, and Lefort in Paris. After his

début in Paris in 1905, he played in the principal cities of Europe. His American début, on Nov. 8, 1908, at Carnegie Hall, N.Y., with the Damrosch Symphony Orchestra, was followed by a concert tour of the United States. He visited Russia in 1910, later reappearing in Europe and in Egypt and Cuba. He has since appeared regularly on both sides of the Atlantic. During the World War he served as liaison officer in the U. S. Aviation Corps. His chief compositions are works for the violin.

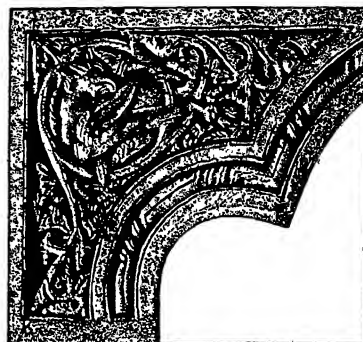
SPALDING, ALBERT GOODWILL (1850-1915), American sporting-goods manufacturer and baseball official, was born at Byron, Ill., Sept. 2, 1850. In 1871-75 he pitched for the Boston Baseball Club, in 1875 organized the National League, and during 1876-91 was successively manager, secretary, and president of the National Association Chicago Club. He was co-founder with his brothers of the firm A. G. Spalding & Bros., manufacturers of sporting goods. He died at Point Loma, Cal., Sept. 9, 1915.

SPALDING, JOHN LANCASTER (1840-1916), American Catholic prelate, was born at Lebanon, Ky., June 2, 1840. Educated at St. Mary's, Baltimore, after his ordination, he became secretary to the bishop of Louisville in 1865. Four years later he built St. Augustine's Church for the Catholic Negroes of Louisville, becoming chancellor of the diocese in 1871. He was made the first bishop of Peoria, Ill., in 1876, resigning in 1908, when he was created titular archbishop of Seitopolis. In 1902 President Roosevelt appointed him one of the arbitrators of the anthracite coal strike. He was the first Catholic prelate to receive the degree of LL.D. from Columbia University. He wrote much on social, educational and religious questions, but his best known work is a biography of his uncle, *Life of the Most Reverend Martin F. Spalding, Archbishop of Baltimore, 1877*. He died at Peoria, Aug. 25, 1916.

SPANDAU, a city of Germany situated on the Berlin-Spandau Canal near the point where the Spree and Havel rivers join. Until 1920 it was a city in the Prussian province of Brandenburg and now is the seat of the 8th municipal administrative district of Greater Berlin. More than half the inhabitants are laborers and a fourth clerks and officials. The 14th century St. Nicholas's Church and a former citadel are worthy of mention. Spandau has important industries; there were 100 large plants and 4,614 smaller ones in 1925. First mentioned in 1197, it became a city in 1232 and was a fortress from 1626 to 1907. It was often the residence of margraves of Brandenburg. Pop. 1925, 111,629.

SPANDREL, in architecture, originally the approximately triangular area between and above adjacent arches, or between the side of an arch and a rib, pilaster or column flanking it. In modern architecture the term is used of the wall area between the head of a window on one floor and the sill of a window immediately above it. One of the ways in which vertical expression is given to modern tall buildings is by paneling the spandrels, or treating them in a con-

trasting color. Spandrel waterproofing is the waterproofing applied to the floor beams at the outside walls in a modern steel-framed structure in order to prevent water which has been absorbed by the window



ROMANESQUE SPANDREL

From the altar-tabernacle of Santa Maria in Valle Forclaneta, Roscio, Italy

sills or wall surfaces from penetrating to the floor below.

SPANIEL, a long-haired dog developed for field work in hunting birds. The cocker is the smallest dog of any kind used with the gun; the clumber the most massive and slowest of the group. Others are the English springer, which quests, finds and springs the game; the all-round field spaniel; the Irish water, a first class retriever; the short-legged Sussex, and the Welsh springer, adapted to rough country. The retrievers are the hardy curly-coated; the flat-coated, suitable for land and water; the golden, bred for soft mouths, and the sturdy Labrador. The Newfoundland, classified as a working dog, is simply an enormous spaniel, as is the St. Bernard. Allied breeds are the setters, including the long-coated English, the Gordon and the Irish. An American development is the Chesapeake Bay, used for duck; the pointer hunts by scent and will retrieve, while the wire-haired pointing griffon was developed for rough country. The Japanese spaniel is a "toy dog," as are four varieties of English spaniel: King Charles, Blenheim, ruby, and Prince Charles.

SPANISH-AMERICAN WAR, 1898, a conflict between the United States and Spain. Popular indignation in the United States over Spanish cruelties and misrule in Cuba, combined with the desire of American capitalists to terminate perennial disturbances in the island, produced a demand early in McKinley's Administration for war against Spain. The destruction, by an explosion yet unexplained, of the United States battleship *Maine* in Havana harbor, Feb. 15, aggravated the ill-feeling. When President McKinley passed the initiative to Congress, Apr. 11, 1898, that body enacted a joint resolution demanding that Spain immediately relinquish its authority in Cuba, and empowering the President to use the military forces to enforce the demand, at the same time disclaiming any intention of the United States to exercise sovereignty over Cuba except for the restoration

of order. With McKinley's call for volunteers, Apr. 25, the war began amid great enthusiasm. The BATTLE OF MANILA BAY, May 1, was the first important engagement and the most notable victory of the war. In Cuba land forces and the American fleet co-operated to effect the surrender of Santiago, July 16, after the destruction of the Spanish fleet in the BATTLE OF SANTIAGO DE CUBA and the land engagements of El Caney and San Juan Hill. (See EL CANEY, BATTLE OF; SAN JUAN HILL, BATTLE OF.) A second American army was completing the conquest of Porto Rico (see PORTO RICO, EXPEDITION AGAINST) when halted by the news of an armistice. A third army, despatched from San Francisco, with the aid of Commodore Dewey's fleet, the Asiatic Squadron, forced the surrender of the city of Manila. Shortly after the loss of Santiago, which involved the passing of Spanish control in Cuba, the Spanish Government began overtures for peace; on Aug. 12 an armistice was concluded, and in Paris (see PARIS, TREATY OF, 1898) the American commissioners substantially dictated the terms of peace.

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SPANISH-AMERICAN WAR: medical service in. See MEDICAL SERVICE, ARMY.

SPANISH BAYONET, a name given to various species of YUCCA with stiff, very pointed leaves native to the southern United States, varieties of which are grown for ornament.

SPANISH BROOM (*Spartium junceum*), an ornamental shrub of the pea family closely allied to the common broom. It is a native of the Mediterranean region widely cultivated in several varieties which are hardy in the central and southern United States. The plant grows sometimes 10 ft. high with flexible rushlike green twigs, usually devoid of leaves, and handsome, fragrant, yellow, pealike flowers. In California the shrub blooms almost throughout the year.

SPANISH DRAMA. The drama appeared in Spain in an elementary liturgical form as early as 950, although no fragment has been preserved which is anterior to the 12th century. In its secular phase, it dates from the 14th century, Gómez Manrique (1412?-1490) being the author of the oldest surviving non-religious play. Passing through the eclogue and mystery (see MYSTERY PLAYS) with Juan del Encina and Gil Vicente, a contemporary touch appears with Bartolomé Torres Naharro (d. 1531?); by the coming of Lope de Rueda (d. 1565), an itinerant actor, manager and author of comedies in the Italian style, play-going had established itself as a recognized feature of national life. The advent of CERVANTES (1547-1616), a great novelist but an indifferent playwright, found permanent theaters flourishing in the principal cities. The drama of the Golden Age, however, is properly the creation of LOPE FÉLIX DE VEGA CARPIO (1562-1635), the most prolific writer in the history of world literature. According to his contemporary, Montalbán, Lope com-

posed 1,800 full-length plays, besides 400 *autos* or sacramental pieces. The titles of 608 plays and 44 *autos* are known, 431 of these having been authenticated and preserved either in manuscript or printed form.

The Spaniards now definitely adopted the division into three acts and abandoned all adherence to classical rules. Religious and historical pieces, tragedy, drama, comedy of adventure and disguise (cloak and sword comedy), together with the pastoral, offering truthful portraits of peasant life, were improvised by Lope in conjunction with such enduring works as *The King the Greatest Alcalde*, *Peribáñez and the Commander of Ocaña*, *Fuente Ovejuna*, *The Gardener's Dog*, *Punishment But Not Revenge* and *The Star of Seville*, although upon linguistic and dramatic grounds the authenticity of the last has been questioned. PEDRO CALDERÓN DE LA BARCA (1600-81) perfected the dramatic structure, elaborated the characterization and heightened the quality of the verse, but not without yielding to "precious" tendencies. With Lope, Calderón shares the hegemony of the theater of the Golden Age, of which his *Life Is a Dream*, *The Wonder-Working Magician*, and *The Mayor of Zalamea* have commonly been accredited the masterpieces. He is also the supreme master of the *auto* (*Belshazzar's Feast*, *The Great Theater of the World*), a development of the mystery and morality carried to a poetic and dramatic height unapproached in other countries. Spanish drama of this period takes its place with the Greek and Elizabethan as the richest and most fecund in history. Tirso de Molina (Friar Gabriel Téllez) (1571-1648), a forceful, untamed genius, composed *Prudence in Woman*, *A Clown Comes to Court*, and *The Love Rogue of Seville*, introducing the Don Juan legend to literature. JUAN RUIZ DE ALARCÓN, Guillén de Castro, Antonio Mira de Amescua, Luis Vélez de Guevara, Francisco de Rojas Zorrilla, and Agustín Moreto excelled also among a galaxy of extraordinary brilliance and variety. The coming of the Bourbon dynasty with Philip V was marked by an incursion of Gallic taste. Following the school of Molière, LEANDRO FERNÁNDEZ MORATÍN (1760-1828) produced the most notable play of the 18th century in *When Women Say Yes*, with the adoption of prose repudiating the traditions of his predecessors. Meanwhile imitations of French tragedy and debased adaptations of the older Spanish playwrights multiplied and received praise. Independently of this Gallic movement, Ramón de la Cruz (1731-94), contributed brief sketches of Madrid life, recalling the more primitive diminutive farces of Luis Quiñones de Benavente (d. 1652?).

The invasion of ROMANTICISM brought the pseudo-classical age to an abrupt close, leaving a number of preposterous melodramas in verse by the Duke of Rivas, Juan Eugenio Hartzenbusch and Antonio García Gutiérrez, several of which have survived as opera libretti, besides a dashing, spirited reworking of the Don Juan story in the *Don Juan Tenorio* of José

ZORRILLA (1817-93), still popular upon the boards. Manuel Bretón de los Herreros (1796-1873) and Ventura de la Vega (1807-65) devoted themselves to high comedy in a more rational, though not less formal spirit, preparing the way for the modern realistic theater of character, foreshadowed by José ECHEGARAY (1832-1916) in his imitations of Ibsen. Originally a turgid Romanticist, Echegaray presents studies of incipient insanity in *Madman or Saint* and of the effects of gossip upon character and conduct in *The Great Galeoto*, 1881, that are largely free from pre-occupations of theatricality. Plot and propaganda in favor of the working class were mingled by Joaquín Dicenta (1863-1917) in his *Juan José*, and a blend of vigorous action and strong provincial color in the *Dolores* and *María del Carmen* of José Feliú y Codina (1847-97) achieved wide acclaim. The proletarian and peasant were first and most radically championed, however, by the Catalan Angel Guimerá (1847-1924), whose *María Rosa* and *Marta of the Lowlands*, together with *The Great Galeoto* constitute the principal contribution of the final quarter of the 19th century to the serious theater. In an effort to escape from a false and exaggerated theatricalism, Benito Pérez Galdós (1843-1920) essayed to introduce the technique of the novel to the stage, notably in *The Grandfather* and *Electra*, but with indifferent results.

To make the transition from artifice to the drama of character and ideas was reserved for JACINTO BENAVENTE (b. 1866), the dominant figure in the Spanish theater since the beginning of the 20th century. Satirist, stylist, critic and a leader in the intellectual regeneration of 1898, Benavente has cultivated every type excepting the poetic play. His preoccupation is with the philosophic and social, the relation of the individual to life in its cosmic aspects and his adjustment to his environment whether singly or conceived as part of the body politic. Characteristic of his dramaturgy is the Quixotic fantasy, *The Bonds of Interest*, 1907, and also the peasant dramas, *Señora Ama* and *The Passion Flower* (*La Malquerida*), the former with suggestions of the grotesque; *Princess Bébé* and *The School of Princesses*, court comedies; *Saturday Night* and *Stronger Than Love*, tragedies of ambition and sacrifice. Cerebral and psychologic conceptions such as *Beyond Death* represent a post-war, post-realistic phase. Accepting the relegation of plot to a secondary position in the structural scheme, the brothers Serafín and Joaquín Álvarez Quintero (b. respectively 1871 and 1873) devised a comedy of atmosphere devoid of conventional situation, consisting rather of sequences of genre pictures of provincial and metropolitan life. *Flowers*, *When Love Goes By*, and *Daughters of Cain* exemplify the potentialities of this new style. A pupil of the Quinteros and of Benavente, Gregorio Martínez Sierra (b. 1881) has captured the spirit of the Spanish convent in his *Cradle Song*, a touching idyll of religious life. Manuel Linares Rivas (b. 1867) also follows the precepts of the modern school. Within the sphere of verse, the contemporary period has manifested a pref-

erence for patriotic subjects, especially in the historical reconstructions of Eduardo Marquina (b. 1879), among which *The Daughters of the Cid* and *Sunset in Flanders* are preeminent. The brothers Manuel and Antonio Machado (b. respectively 1874 and 1875) have written sparingly in this field. Other poetic dramatists include Francisco Villalpesa (b. 1877) and the novelist Ramón del Valle-Inclán (b. 1869), whose highly decorative Barbaric Comedies in prose, *Song of the Wolves* and *An Eagle on His Shield*, belong to the library rather than to the footlights.

In conclusion, two offshoots of the modern theater, the one-act play and the Catalan stage, demand attention. The *Apolo* Theater in Madrid, inaugurated in 1881 the experiment of dividing the evening into sections, or *funciones*, at each of which a short piece was presented. There ensued in consequence an unprecedented efflorescence of the one-act play, which for 30 years maintained a popular supremacy. The names of Ricardo de la Vega, Miguel Ramos Carrión, and Vital Aza during the last century, and Carlos Arniches in the contemporary period, have been intimately associated with this lesser genre. The continued use of the Catalan language in Barcelona, reinforced by political motives, induced a revival of the Catalan drama through the labors of Frederich Soler (1838-95) and its installation in the *Teatro Romea* of that city in 1867. Angel Guimerá, already discussed in connection with his translator Echegaray, was a product of this movement, in his later works renouncing with the Spaniards the dominance of plot for a formless naturalism approximating the Sicilian experiments of Luigi Capuana. A sentimental humanitarianism informs also the proletarian plays of Ignasi Iglesias (1871-1928), while a pervading eclecticism, esthetic as well as philosophic, has in increasing degree deprived the Catalan development of its racial character. Typical of this tendency is the painter-poet Santiago Rusiñol, whose drama, *The Mystic*, has passed with certain of the peasant pieces of Guimerá into the heritage of the national speech.

J. G. U.

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SPANISH FLY, a European species of BLISTER BEETLE used for making blister plasters. Bodies of dead beetles are dried and pulverized, and a paste made from the powder thus obtained. When applied to the skin, it produces a blister.

SPANISH GUINEA, a Spanish possession on the Gulf of Guinea, West Africa, includes Río Muni, the densely forested mainland, and several small islands, the largest of which, Corisco, has an area of 5½ sq. mi. The total area is 10,036 sq. mi. A small trade is carried on in cocoa, coffee, sugar and forest products. Fishing is the islanders' chief occupation. The only places of note are Benito, on the estuary of the Benito

river, and Bata. Spanish Guinea is administered from Fernando Po, one of the Gulf Islands. Pop. 140,000, including less than 200 whites.

SPANISH LANGUAGE, an important ROMANCE language. Its original domain was the greater part of the Iberian Peninsula, with the exception of the areas of Catalan, Basque (in Navarra), Galician or Gallego, and Portuguese (see separate articles on these subjects); and it is now spoken also in Central and South America, excepting in Brazil, as well as by some 100,000 Jews expelled by the Inquisition and scattered over the former Turkish Empire in Europe (see JUDAEO-SPANISH).

The least dialectalized of western Romance languages, Spanish is essentially the Castilian form, which spread from the north with the reconquest of the country from the Arabs. Its principal vocalic characteristic is the diphthongization of Latin *e* and *o* (e.g., Latin *terra* = Spanish *tierra*, "land," Latin *bonu*^m = Spanish *bueno*, "good"). In consonantism, Latin *mn* generally becomes *ñ* (pronounced like English *ni* in "onion"), as Latin *dom(i)na* = Spanish *doña*, *dueña*, "lady"; and, through a change admittedly of IBERIAN or BASQUE origin, initial Latin *f* has become *h* except before *ue* arising from Latin *o* (e.g., Latin *faba* = Spanish *haba*, "bean," but Latin *forte* = Spanish *fuerte*, "strong"). The morphology and syntax are in general similar to those of FRENCH and ITALIAN; and the vocabulary, attested in literature by the 12th century, contains a great number of ARABIC words, distinguished by the Arabic article, *al*, as *alguazil*, *alcalde*, etc. H. F. M.

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SPANISH LITERATURE. Spain has never been a homogeneous entity. Leon, Castile, Aragon, Catalonia, Galicia and other less individual provinces or kingdoms have had each a separate life and tongue. The invasion of the Moors, 711, did not suffice to unify the Christians. That Castilian has been for centuries and is to-day the dominant language is due in part to early abundance of literary production and in part to the whip-hand of political ascendancy.

The literature of Spain, like its people, is individualistic, spontaneous and unrestrained, sometimes prolix and rhetorical. Polish and measure are the exceptions. The Spaniard does not enjoy the construction of a logical universe, and is therefore unlikely to explore the depths of philosophy. Neither faith nor pessimism is his abiding belief. He observes life with an open mind, and transmits his comments freshly, wholesomely, with the charm of unsophistication. Moral austerity, realism in the best and purest sense, a popular spirit carried over into art, these are the most permanent characteristics of Spain in letters.

Middle Ages. Spanish literature, i.e., Castilian literature of the Iberian Peninsula, begins with an epic. The *Poema del Cid*, c. 1140, in assonated *laissez*, naïve, enthusiastic and partly historical, cele-

brates a national hero. Other similar epics (*mester de juglaría*), most of them now lost, mirrored heroic struggles between Moors and Christians or between the several Christian kingdoms. Clerical verse (*mester de clerecía*) in Alexandrine quatrains was concerned with epic themes (*Poema de Fernán González*, c. 1250), religious legends (Gonzalo de Berceo, d. about 1250), or pure romance (*Libro de Apolonio*, *Libro de Alixandre*). The same quatrains (*cuaderna vía*) were used by Juan Ruiz, Archpriest of Hita (1283?-1350?) for his genial, mischievous and modernly conceived *Libro de buen amor*, and by the statesman Pero López de Ayala (1332-1407) for satire and moral reflection, *El rimado de palacio*. The Middle Ages produced also brief lyric-narrative verse in couplets, without brilliance or originality. The popular lyric is a matter of inference. The cultured lyric, as of ALFONSO X, was written in the Galician tongue, following a place and mode determined from Provence. See PROVENÇAL LITERATURE.

Medieval drama has a single representative, *El misterio de los Reyes Magos*, c. 1200. From then till nearly 1500 Spanish drama, surely existent within and without the Church, is only to be inferred from allusions. The influence of France can be seen in every one of the poetic forms named up to this point.

Medieval prose ran chiefly to the Oriental-mannered moral tale, of which the best collection is Don Juan Manuel's *El Conde Lucanor*, 1328-35, or to law (*Las siete partidas*) and history (*La crónica general*) compiled under the direction of the scholar king, Alfonso X (d. 1284). Pedro López de Ayala (1332-1407) wrote admirable first-hand *Chronicles*. Romance was more likely to be composed in verse, but the beginnings of the prose romance of chivalry fall within this time (*El caballero Zifar*, c. 1300; *Amadis de Gaula*).

Fifteenth Century. This century witnessed a premature first filtration of the Renaissance from Italy, but a nation absorbed in its local crusade against the Moors could devote but little energy to study, and for another century antique learning and culture remained waiting at Spain's threshold. The Marquis of Santillana (1398-1458), though a scholar, wrote popular lyrics (*serranillas*) better than imitations of Dante. Juan de Mena (1411-56) could do only the latter (*El laberinto de Fortuna*, c. 1444), in a galloping anapestic rhythm of popular origin called *arte mayor*. The vogue of this curious verse form lasted hardly a hundred years. There are vast collections of cultured amorous and satirical ditties (*Cancionero de Baena*, c. 1445). Jorge Manrique's *Coplas por la muerte de su padre* (1477?) is one of the world's great elegies; Longfellow gave it an excellent English rendering. But the poetic masterpieces of this time are the folk-ballads (*romances*) which, from before 1400 till after 1500, replaced the medieval epic with a body of brief, earnest, stirring lays.

Prose, too, dealt with history (Fernán Pérez de Guzmán, *Generaciones y semblanzas*, c. 1450; Hernando del Pulgar, *Claros varones de Castilla*, 1486). More rich and ebulliently Spanish is the satirico-didac-

tic *Corbacho*, 1438, of Alfonso Martínez de Toledo, Archpriest of Talavera. The sentimental novel of pining and suicide (*La cárcel de amor*, 1492, by Diego de San Pedro) soon gave way to more lasting forms.

Sixteenth Century. With the discovery of America explosive energy inspired the Spanish people. Every branch of literature was enriched. The period from 1530 to 1681 is often called the Golden Age. The lyrics of the *Cancionero general*, 1511, are only relics from the former century. But Italianate poetry, with its eclogues, odes and sonnets, was heartily adopted by Juan Boscán and brought to luscious fullness of perfection by GARCILASO DE LA VEGA (1501?-36). His path was followed by Fernando de Herrera, by the Horatian religious Fray Luis de León (1527?-91), by the mystic San Juan de la Cruz, the brothers Argensola, and many more. Wholly Italianate was the cultured epic (Ercilla, *La Araucana*, 1569-90). The octosyllable native verse flourished at the same time, however, and the *Romancero general* (1600-04) shows how the old ballads suffered a polished and artificial transformation.

Drama, always in verse, sprang into light with Juan del Encina (c. 1468- c. 1529), the Portuguese Gil Vicente (c. 1465- c. 1536) and their followers in the churchly-pastoral mode. Torres Naharro, writing in Italy, initiated a more secular, romantic and Plautine manner. These two currents may be traced side by side till the "monster of Nature," LOPE DE VEGA (1562-1635), author of some 2,000 intrigue plays, by his own effort created the typical Spanish three-act *comedia*, with all its formal weaknesses and its fascinating sparkle and motion—a forerunner of the cinema.

One authentic prose masterpiece of Spain, the *Celestina* (*Comedia de Calisto y Melibea*), (1499-1502) is both drama and novel. Its 21 dialogued acts, surely never performed, carry a tale of passionate and tragic love, sumptuously framed in scenes of the most varied contemporary life. The central go-between stems from Ovid and Juan Ruiz, and her tradition endures in Europe to this day. The *Celestina* is medieval and modern. The romances of chivalry, of Breton inspiration, *Amadís de Gaula*, printed in 1508, and many more, are the pure spirit of the Middle Ages. They sublimated the ideals of a roughly expanding nation, as the pastoral novels (Jorge de Montemayor, *La Diana*, 1559?), literal importation from Italy, afforded a refuge from real life. Reacting from these aristocratic fashions, an unknown invented the picaresque novel (*Lazarillo de Tormes*, 1554), original and far-reaching. Here the rotten pilings of society, the basic foibles of Spanish character, are cruelly exposed. The Church took umbrage at its own sorry rôle in the caustic anti-heroics of the picaresque, and in the later forms compelled heavy insertions of misplaced moralizing (Mateo Alemán, *Guzmán de Alfarache*, 1599-1604). Miguel de Cervantes Saavedra (1547-1616) possessed the temper of the 16th century, though *Don Quijote* (1605-1615) and the *Novelas Ejemplares*, 1613, fell in the 17th. A maimed sol-

dier, a stout-hearted captive for five years in Algiers, a tax-collector imprisoned for short accounts, CERVANTES wrote with the ripe tolerance of a great and tested spirit. Under the guise of a satire upon the romance of chivalry he created a two-fold image of Spain, the aspiring and the practical.

Historians were legion. The great conquests in America gave them the amplest and most unusual material (López de Gómara, Bernal Díaz del Castillo, the Inca Garcilaso). The dying rebellion of the Moors (1568-71) was sympathetically narrated (Ginés Pérez de Hita, Diego Hurtado de Mendoza). Yet the most famous Spanish historian, Juan de Mariana (1535?-1624) is known for a conventional *History of Spain*, in Latin, then in Spanish, excelling more by reason of form than matter.

Erudition thrived in grammar and folklore, morality did not lack preachers (Antonio de Guevara, 1480?-1545). Religious thought opened auspiciously with Erasmic investigators (Alfonso and Juan de Valdés), but Spain soon saw that the Inquisition pointed her true way. Pious rhetoricians (Fray Luis de Granada), interpreters of life and letters (Fray Luis de León), and mystics (St. Teresa, San Juan de la Cruz, Malón de Chaide) carried sacred fervor and Castilian style to a pitch never since attained. Mysticism, indeed, for all its glorious flowering, is not to be regarded as uniquely or permanently Spanish; it sprang from many foreign elements and its seed was short-lived in Spain.

Seventeenth Century. The century began with opulent simulations of vitality, but decadence lurked beneath. Poetry was cankered by the esoteric preciousness of which Luis de Argote y Góngora (1561-1627) was the outstanding genius and fugleman in Spain (*Soledades*, 1613?). Even the bold satire of Francisco de Quevedo (1580-1645) did not escape conceit mannerism. Drama, to be sure, reached its prime with Lope de Vega and his followers ("Tirso de Molina," *El burlador de Sevilla*, prototype of Don Juan: Ruiz de Alarcón, etc.), but the prime was not sound. PEDRO CALDERÓN DE LA BARCA (1600-81), amid the stereotyped puppets of his *comedias*, was sufficiently preoccupied by universal problems to create two masterpieces, *La vida es sueño* and *El alcalde de Zalamea*. His true bent, however, philosophic symbolism, appears best in the eucharistic allegories called *autos sacramentales*.

Prose produced a rapidly degenerating picaresque (Vicente Espinel, *Marcos de Obregón*, 1618; Quevedo, *El buscón*, 1626; Vélez de Guevara, *El diablo cojuelo*, *The Limping Devil*, 1641), and history more notable for style than substance (Francisco Manuel de Melo, Antonio de Solís). One great but contorted thinker, Baltasar Gracián (1601-58), showed himself a pessimist (*El crítico*, 1651-57) and an advocate of worldly wisdom (*Oráculo manual*, 1647). After him the swift and complete political decline of Spain was thoroughly reflected in her letters.

Eighteenth Century. In the 18th century French kings and French rationalism imposed on them an

unwonted and somewhat unsuited turn. Boileau with his unities, Diderot with his *Encyclopédie*, set Spaniards to writing formally and studying dispassionately, scientifically. (See FRENCH LITERATURE.) The Spanish Academy, founded in 1714, published the first authoritative dictionary, 1728-39. The educational spadework of Padre Isla (*Fray Gerundio*, 1758-68) and Padre Feijóo was not showy, but it was useful. Erudition revived. Literature remained empty and vapid till the close of the century, when Samaniego and Iriarte indited clever fables and Juan Meléndez Valdés and his friends toyed with Louis-Quinzian pastorals in verse. Drama fared better. The *sainetes*, brief comedies of popular manners, of Ramón de la Cruz (1731-94) were in good Spanish fashion. The bourgeois character comedies of Leandro F. de Moratín (1760-1828) were in equally good French fashion. The novel was all but extinct, and prose at its best ran to political science (Gaspar Melchor de Jovellanos (1744-1811)).

The 19th Century. This period began with war. The Napoleonic invasion roused patriotism to odes of resistance (Manuel José Quintana, Juan Nicasio Gallego); but victory brought only the stifling reign of Fernando VII (1814-33). With his death a belated, brief and half-hearted ROMANTICISM gave birth to fluent, dilute verse (Espronceda, Zorrilla, Rivas), extravagant or sentimental drama (*Don Álvaro*, 1835; *El trovador*, 1836; *Don Juan Tenorio*, 1844), and some weak Scottian novels. The strength of this period lies in the savage satirical *Articles* of Mariano José de Larra (1809-37), "Fígaro." By their sketches of manners he and certain congeners laid the foundation for the later regional novel. Close kin were the witty verse character comedies of Bretón de los Herreros (1796-1873). Imitation of French thesis plays marks the prosaic mid-19th-century; but *Un drama nuevo* (1867) by Manuel Tamayo y Baus is a powerful effort in pure drama. José Echegaray (1832-1916) was a romantic Ibsenite. In poetry a rare note of sincerity and passion was heard from the Andalusian G. A. Bécquer and the Galician Rosalía de Castro. There are French echoes of the *mal du siècle* in G. Núñez de Arce, and playful pessimism in Ramón de Campoamor. Their basically in-artistic modes gave way to Verlainism led by the Nicaraguan RUBÉN DARÍO (1867-1916). But Spain's great contribution to the 19th century was the regional novel of Juan Valera, Señora Emilia Pardo Bazán, J. M. de Pereda, A. Palacio Valdés, V. BLASCO IBÁÑEZ and B. Pérez Galdós, the last less regional than speculative and propagandist. Each lent his peculiar manner to a truly imposing and in the main remarkably uninfluenced corpus of characters and customs.

Modern Spanish Literature. The Spanish-American War marked an era. Defeat pierced the shell of Spanish pride and with the deflation rhetoric and national vanity escaped. Essayists such as Unamuno, Ganivet, "Azorín," dramatists (Benavente), novelists (Pío Baroja, Ramón del Valle-Inclán, Ricardo León) and philosophers (Ortega y Gasset) re-

vised their traditional values, queried and pondered. Poets either followed Darío (Juan Ramón Jiménez) or in their own way cultivated concision (Antonio Machado). Almost the sole optimists of the time were the brothers ÁLVAREZ QUINTERO, masters of delicate sentimental comedy; for G. Martínez Sierra, in the same field, purveys a more wistful emotion. The present does not see conspicuous new talents.

S. G. M.

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SPANISH SUCCESSION, WAR OF THE, (1701-14), a war officially concerned with the succession to the Spanish throne following the death of the childless Charles II in 1700. Charles II willed his dominions to Philip of Anjou, grandson of Louis XIV, while the counter-claimant put forward by the powers of Europe was Charles, second son of the Emperor Leopold I. Actually the war was the climax of many long standing European questions, of which the chief was the enormous power and aggressiveness of France which in the Peace of the Pyrenees, 1659, had shown Spain a shattered cripple, and now 40 years later was seeking to annex her and her vast colonial empire to the French policy of European and maritime expansion. England and Holland looked on the union of the two thrones in the House of Bourbon as a direct menace, for it created a power holding the coast from the Scheldt to Gibraltar with powerful fleets and wealthy oversea colonies. To Austria, already facing a hostile France on the Rhine, it added the pressure of the Spanish in Milan.

Before Charles II died treaties had been made by the powers to divide the spoils. Despite this Louis XIV allowed the candidature of his grandson, and when Philip was received in Madrid in Feb. 1701, he determined to take all for France. An alliance between England, Austria and Holland was quickly formed and in September the war opened. Bavaria, fearful of Austria, and Cologne supported France; most of the other small states, the allies. None of the war was fought in France, save for the unrelated rising of the Camisards in the Cevennes, but raged about the Spanish fortresses in Flanders, along the lower Meuse and Rhine, in the Palatinate and Baden on the upper Danube (see **BLenheim, Battle of**), in northern Hungary where the Turks found the war an opportunity to attack Austria, in the Po valley, and in eastern Spain. On the sea the British captured and retained Gibraltar and Minorca, while the naval power of both France and Holland suffered severely. The war in general had gone against the French, though neither side was ready for peace, when in Apr. 1711 the situation was suddenly altered by the death of Emperor Joseph I leaving his throne to his younger brother, the allied claimant for the Spanish crown, the Emperor Charles VI. The actual union of the Empire (Austria) and Spain, was more distasteful to

England, Holland and many of the German states than a mere dynastic union of France and Spain, provided valuable concessions could be obtained from France in return for peace. Negotiations opened at once and peace was concluded at Utrecht (*see* **UTRECHT, PEACE OF**) in 1713. Austria continued the war in a desultory fashion for another year, concluding peace at Rastatt in 1714. The chief commanders in the war were Prince Eugene for Austria; Marlborough for England, and Villars for France. *L. BR.*

SPAR, a popular name for certain mineral forms. **CALCITE** in steeply conical crystals is called *dog-tooth spar*, and exceptionally clear pieces from Iceland are known as *Iceland Spar*. Because of its pearly appearance, **DOLOMITE** is named *pearl spar*. Brown spar is **MAGNESITE**, referring to its rapid discoloration on exposure. **BARITE**, a heavy mineral, is also known as *heavy spar*. Adamantine spar refers to the hardness of **CORUNDUM**. *See also SATIN SPAR; ADAMANT.*

SPARK PHOTOGRAPHY. For photographing a very rapidly moving object, such as a bullet in flight, it is difficult to obtain a mechanical shutter which will operate fast enough to arrest the motion. To obviate this difficulty, the photograph is made in a darkened room and the illumination is furnished by an electric spark. The very short duration of the spark determines the length of exposure. An ingeniously devised switch must be employed for discharging a **CONDENSER** to produce the spark when the projectile is in the desired position. The switch usually employed is a diaphragm operated by air waves set up by the motion of the projectile. Ordinarily, a **LENS** is not employed and the photographs are really silhouettes. *I. C. G.*

SPARK PLUG, a metal plug introduced into the side or top of the combustion chamber of the cylinder of an **INTERNAL COMBUSTION ENGINE** carrying one or two insulated terminal points across which an electric spark jumps. In the *make-and-break* type, now largely employed in marine engines, the points are held together and pulled apart at the proper time. In the *jump-spark* type, which are used with a **MAGNETO** or **INDUCTION COIL**, the points are fixed, the spark jumping across them. *See also DISTRIBUTOR.*

SPARKS, JARED (1789-1866), American historian and biographer, was born at Willington, Conn., on May 10, 1789. He graduated in 1815 at Harvard, later studied theology, and in 1819-23 was pastor of the Unitarian Church in Baltimore. In 1823 he purchased the *North American Review*, and served as its editor for seven years. During this period he began collecting and editing historical documents relating to the Revolutionary period in American history, which became his chief life work. Among the works edited by him were: the *Writings of George Washington*, 12 volumes; the *Diplomatic Correspondence of the American Revolution*, 12 volumes; *The Library of American Biography*, 25 volumes; and *The Works of Benjamin Franklin*, 10 volumes. Although Sparks has been criticized for his rather arbitrary emendations of original texts, it cannot be denied that his

exhaustive researches proved an invaluable contribution to his field of endeavor. Of his original works, *The Life of Gouverneur Morris* and *Remarks on American History* are the most important. He was made McLean professor of history at Harvard in 1839, and served as president of the college in 1849-53. He died at Cambridge, Mass., on Mar. 14, 1866.

SPARK TRANSMITTER, a **RADIO TRANSMITTER** used for code signals only, creating trains of **DAMPED WAVES** by the oscillatory discharge of a capacitance-inductance system across a spark gap. Such transmitters have been largely replaced by thermionic-tube oscillators which produce undamped and continuous wave trains. *See also OSCILLATOR, ELECTRIC.*

SPARROW, a bird of that division of the family *Fringillidae*, characterized by prevailingly brown and streaked plumage. Sparrows are more thoroughly terrestrial than are the finches, buntings or grosbeaks, also included in this great heavy-billed family. They are most numerous in northern lands, but are found elsewhere wherever open spaces suit their ground-dwelling habits. Avoiding forests, they find in prairies and glades the grass and herbage that furnish varied seeds for food and hiding-places for their nests. The modern civilization of much of the globe has therefore been to their advantage. American sparrows have increased with the enlargement of land-cultivation, repaying for the privilege by devouring a vast quantity of noxious weed-seeds and harmful insects. *See HOUSE SPARROW.*

SPARTA, a city and city state of ancient Greece, situated on the Peloponnese; the city survives to-day in a small town, built in 1834 on the site of the ancient city. Sparta was about 20 mi. from the coast on the Eurotus River. The city also was called Lacedaemon after its legendary founder, male child of Zeus and Taygete, for whom the mountains on the west of Sparta were named Taygetus. The early inhabitants, Achaeans, were driven out by the Dorians. Lycurgus was the most famous of the Spartan law givers. His constitution was the basis of the government. Two kings ruled, but their power was limited by the ephors and gerousia, and a general assembly of the people called apella. The system of rigorous training undergone by the youths of Sparta gave birth to the adjective *Spartan*; the weaker children were exposed, and the stronger, at the age of seven, were taken into the custody of the state which trained them in physical exercises, warfare and bravery in battle. All trade was in the hands of the perioeci and the helots tilled the soil. Sparta was at the height of her power in the 5th century B.C. Alaric destroyed the city in 396. Pop. 1928, 5,799.

SPARTACUS, leader of a slave revolt of (73-71 B.C.), in Italy. A Thracian by birth, escaped with a group of companions from a gladiatorial training school at Capua and took refuge on Mt. Vesuvius. There he soon assembled an army of desperadoes who, marching through Campania and Lucania, swept all before them, defeating several armies. Finally Crassus defeated the slaves and Spartacus was killed.

Spartacus was a capable leader whose memory always filled the Romans with dread.

SPARTANBURG, a city and the county seat of Spartanburg Co., in northwestern South Carolina, situated about 205 mi. north of Atlanta, Ga. Four railroads, bus lines and airplanes serve the city. The chief crops of the vicinity are cotton, grain and truck products. The city is an industrial center producing textiles, machinery, paint and other manufactures. In 1929 the value of the factory output was about \$8,000,000; the retail trade amounted approximately to \$15,940,000. Spartanburg derived its name from the Spartan behavior of American troops at the Battle of Cowpens during the American Revolution. The city was incorporated in 1831. Wofford College and Converse College are located in Spartanburg. Pop. 1920, 22,638; 1930, 28,723.

SPARTAN CONSTITUTION, the most conservative political system of ANCIENT GREECE. It was a complicated combination of survivals and innovations, intended to check and balance. Two kings, nominally at the head of the state, were actually merely leaders in war and religious officials. Besides curtailing each other's powers, they were controlled by a body of five ephors, to whom they were responsible. The kings with 28 advisers formed the gerusia, or council. Both the 28 advisers and the five ephors were elected by an assembly of adult male Spartiates, called the apella. Executive capacity, as observed, was divided; the same was true of judicial and legislative functions. The civil court was the college of ephors, while the gerusia had criminal jurisdiction over citizens. Legislation could not be initiated nor debated by the apella. The council prepared measures; the ephors considered whether they were to be offered to the apella, where they were finally rejected or accepted by acclamation. Thus every law had three obstacles before it. Finally, a distinction in tenure of office prevented the ephorate, which was the keystone of the constitution, from bringing too great power to an individual, for it alone was not a life position. Each year ephors were elected, and their names were used for the dating of measures. This constitution, which was considered of great antiquity by the Spartans, presents a mixture of monarchy, oligarchy and democracy, unique in the ancient world, and was generally admired by the Greeks as the most theoretically perfect constitution in practice.

SPASTIC PARALYSIS. See PARALYSIS.

SPATTER-DOCK (*Nuphar advena*), a perennial aquatic herb of the water lily family, called also yellow pond lily. It is native to shallow ponds and slow streams throughout eastern North America. From thick fleshy horizontal rootstocks rise broad, heart-shaped, floating and emersed leaves, a foot long, and large, globose, yellow, sometimes purple-tinged flowers borne on stalks rising above the surface.

SPEAR GRASS (*Stipa elegantissima*), an ornamental perennial closely allied to PORCUPINE GRASS. It is a native of Australia cultivated for its large feathery flowering panicle.

SPEARMINT (*Mentha spicata*), a smooth perennial herb of the MINT family closely allied to the PEPPERMINT and widely grown in gardens for its pungent leaves used in flavoring and for its aromatic essential oil. It is native to Europe and Asia and widely naturalized throughout North America. The plant grows about a foot high with erect branching stems bearing narrow, sharply toothed leaves and numerous small purplish flowers produced in slender, interrupted, mostly terminal spikes.

SPECIAL SERVICE SQUADRON, a squadron of four or more cruisers of medium tonnage under the command of a rear admiral, based on Panama. This squadron was organized in 1920 to relieve conditions in both the Atlantic and Pacific fleets whereby in case of need for their service it became necessary to draw cruisers or destroyers from their regular duties to proceed to Central American, Caribbean or Isthmian waters. The squadron's duties are to protect lives and property of the United States and foreign citizens in any country in the regions mentioned when endangered; and also to pay visits of courtesy to Latin-American ports and to cooperate with the State Department's representatives in these respective countries.

R. E. C.

SPECIALTY STORE. See DEPARTMENT STORE.

SPECIE PAYMENT, the redemption of paper money. It applies equally to BANK NOTES and to TREASURY NOTES, the value of which rests ultimately upon the fact that they are redeemable in specie, since specie is the only medium by which international payments can be effected. When the specie reserves of the banks fall so low that they can no longer redeem their notes, or when the government treasury becomes so impoverished that it can not make this redemption, specie payments are said to be suspended, and the value of the paper money falls below that of specie, the discount depending upon the relative volume of the circulation. Notorious examples of the suspension of specie payments occurred in the United States during the Revolutionary War, when the notes issued by the Continental Government sank almost to nothing in value; during the Civil War when the GREENBACKS were at a high discount in terms of gold; in England from 1797 to 1821; in France during its Revolution, and in most of the belligerent nations during the recent World War.

When specie payments are suspended, the former relations between currencies of different countries cease to hold good, since they were based on specie content or MINT PAR. The foreign exchange rate ceases to be limited by the GOLD POINTS, and may vary widely, depending upon the relative purchasing powers of the money in the countries concerned.

The restoration of specie payments is a far more difficult task than the suspension, since it may involve a reduction in the circulation, with all the social and economic disadvantages of deflation, and the building-up of a new coin reserve sufficient to meet the demand for redemption.

B. H. B.

SPECIE POINT. See GOLD POINT.

SPECIE RESUMPTION ACT, passed Jan. 14, 1875, a bill providing for the resumption of specie payments (suspended in 1861) by the United States Treasury on Jan. 1, 1879; gradual retirement of greenbacks until the greenback circulation should be reduced to \$300,000,000 and their redemption in coin; the discontinuance of paper fractional currency and the substitution of silver coin, and free coinage of gold. The measure, sponsored by Sen. John Sherman, represented a compromise between conservatism and the demands of the GREENBACK PARTY. The promise of resumption improved the credit of the United States. Greenbacks were worth 89 cents in coin in Jan. 1875, 96 cents in 1877, and in Dec. 1878, reached par.

SPECIES, in taxonomy, a coherent group of individuals that resemble one another as much as they would if all descended from a common ancestor in the recent past. The individuals of a species usually interbreed. Previous to the acceptance of the theory of organic evolution a species was regarded as a fixed entity; all the individuals of a species were believed to have descended from a single pair originally created. According to the theory of evolution the lines of descent are constantly diverging and intertwining. When the divergence is sufficient to separate a group so that intergrades between it and allied groups are few or none, that group of individuals becomes a distinct species. Many species have become extinct but others are constantly in the making.

Some species are well marked and distinct from all others, and may show little variation. Other species are variable, showing many subgroups which, however, are connected by intergrades. Such species appear to be on the way to forming a series of distinct species. Biologists may not agree as to whether these subgroups are distinct species or are all parts of one variable species. To illustrate the usual concept of a species, zoologists regard all the races of mankind as belonging to a single species; most botanists regard all the varieties of corn (maize) as belonging to a single species. A group of allied species forms a genus. A. S. H.

SPECIFICATIONS are the formulated, definite, and complete written statements of what the buyer requires of the seller or what the engineering department determines as desired characteristics of articles manufactured to which the production department must conform. Through the medium of specifications, the producer, the distributor, and the consumer are able to speak a common language. For a specification to be truly effective, it should give in clear and concise terms detailed information concerning the types, designs, composition, grades and quality of the material or product to be manufactured or delivered. The specification should be so worded as to preclude any misunderstanding on the part of those who must use it as to what is actually wanted. A good workable specification should also contain definite statements relative to the necessary methods for inspecting or testing the commodity delivered in order to deter-

mine whether or not it complies with the requirements set forth in the specification. R. A. M.

SPECIFIC GRAVITY. See DENSITY.

SPECIFIC HEAT, the number of CALORIES required to raise the temperature of one gram of a substance 1° C., or the number of BRITISH THERMAL UNITS required to raise the temperature of one pound 1° F. Numerically, the value is the same in either case.

In many calculations, the specific heat of a substance can be treated as a constant. However, it actually varies more or less gradually with the temperature. Also, any modification in molecular arrangement as, e.g., the recalcence of iron, may produce an abrupt alteration in specific heat.

Dulong and Petit's law states that the product of the specific heat of an element and its ATOMIC WEIGHT, i.e., the *atomic heat*, is approximately 6.4 calories. This holds approximately for most of the elements which are ordinarily solids, but several, including BORON, CARBON and SILICON, show wide departures from it. If Dulong and Petit's law were absolutely true, the specific heats of all atoms would be the same. Much important work has been done recently on the QUANTUM THEORY of specific heat, notably by Debye and his associates. W. W. S.

SPECIFIC PERFORMANCE. Under the common law system which obtains in England and the United States, the court in an action at law renders a judgment for damages for non-performance of a contractual or statutory duty owing by the defendant to the plaintiff. It frequently happens that damages are not an adequate remedy, that is, they will not procure for the plaintiff substantially what his legal right entitles him to. In such cases a court of equity will decree specific performance, that is, will require the defendant to do substantially and exactly what he contracted to do.

SPECTACLE LENSES. The earlier spectacle lenses were equi-curved or had one plane surface. Imagery through the center of such lenses is satisfactory, but objects viewed through the marginal portion of a strong lens of this type are badly blurred by ASTIGMATISM. To correct this, the lens should be convex on one side and concave on the other, with the concave surface toward the eye. An exact solution for this correction would require different curvatures for each power, and such lenses would necessarily be very expensive. Compromise series of lenses have, accordingly, been developed in which the astigmatism has been satisfactorily corrected. Thus, only a limited number of standard curvatures are required.

Bifocal lenses are lenses, one portion of which is adapted for near, the other for far vision. Originally, two separate lenses were cut to fit in a single frame and later a small supplementary lens was cemented on a larger lens. In each of these forms the prominent dividing line is objectionable. The newer bifocals are of two types. In one, two pieces of glass are fused together, the indices being so chosen that when both surfaces are spherical the two portions of the lens

will have the required difference in power. In the second type, a method of grinding and polishing has been developed by which the two portions of the surface may be ground to different radii of curvature, the two portions being separated by a sharp line which is almost invisible. *See also* LENSES; OPTICAL GLASS; ABERRATION IN OPTICAL SYSTEMS. I. C. G.

SPECTACLES. Reading glasses were introduced in Europe shortly before the year 1280. The first recorded suggestion of this use for convex lenses is in the writings of Friar Roger Bacon and it is probable that a member of his Franciscan order carried the knowledge to Italy. In a church in Treviso is the oldest portrait, painted in 1352, in which spectacles appear.

Until printed books became generally accessible, the demand for spectacles was limited. The best early lenses were chiefly made in the glass-blowing establishments at Venice and Nürnberg, but their cost was prohibitive to all but the very wealthy.

The first lenses were convex, and used almost entirely by the aged to help their failing vision; concave glasses did not appear until over two centuries later—our earliest record being a painting by Raphael, done in 1517, in which the myopic Pope Leo X is shown holding a concave lens. Numerous observers later noted that many individuals with weak eyes were not benefited by either convex or concave glasses. Thomas Young, in 1801, supplied the explanation when he recognized astigmatism in his own eyes, and George Airy, in 1827, demonstrated that the condition could be corrected by a cylindrical lens.

To Benjamin Franklin belongs the credit of inventing bifocal glasses in 1784. These consisted simply of two divided lenses held together in a frame, the upper segment serving for distant vision, the lower for reading. The cement bifocal appeared in 1866, but in turn was displaced by the "invisible" fused bifocal in 1890. Originally in this lens the reading addition of flint glass was fused to the distance lens of crown glass, but recently a type has been developed with negligible chromatic aberration by using borosilicate crown glass or, better, dense barium crown glass in the reading segment.

The earliest text on how to fit glasses came from Daza de Valdes of Seville in 1628. At this period, the fitting and making of lenses had come under the control of spectacle makers' guilds, who took as their patron the learned St. Jerome. Only in the past century have physicians been concerned with glasses, and they are indebted to Donders, a Dutch ophthalmologist, for their present views. Donders stressed the value of temporarily putting to rest the focusing mechanism of the eye by the instillation of drugs. His classic work, *The Refraction and Accommodation of the Eye* (1864), first placed the study of physiologic optics on a scientific basis. The next advance was the invention by Cuiquet of the retinoscope, which permits an objective and accurate determination of the refraction.

Ophthalmic lenses are at present graded according

to their focal power. The unit, a diopter, is a lens with a focus of one meter. In a 40 mm. lens of this power, there is .4 mm. difference in thickness between center and edge. Flat lenses, when very small lenses were worn, were sufficiently adequate, but with larger lenses came a demand for improved forms. The deeply curved lens, ordinarily known as "toric," reduces marginal astigmatism, and the "punktal" type is a still further improvement.

Tinted lenses are useful as a protection from the excessive glare of snow, water, sand, or acetylene torches.

"Goggles" are spectacles designed to shield the eyes from injury by wind, dust, or flying particles. In the best aviation goggles, the lenses are curved and the rims backed by rubber cushions, fur, or chenille. When there is special danger of breaking, tempered glass or laminated glass is used, the latter consisting of two sheets of optical glass with a transparent binder between, which will hold the fragments together, should the glass ever crack.

Telescopic spectacles are low-power, wide-angle, binocular telescopes compactly made. They are valuable in cases of ocular disease where ordinary glasses give but little aid.

For special cases, and in order to avoid the cosmetic disadvantage of thick lenses, contact glasses worn directly over the eyeball have been recently suggested. They are, however, quite expensive, and can be worn for only short periods. J. E. L.

SPECTATOR, THE. 1. A noteworthy English periodical, published daily from Mar. 1, 1711 to Dec. 6, 1712 (revived 1714), famous for the papers published in it by JOSEPH ADDISON and RICHARD STEELE. The masterly contributions of Addison, which included the classic SIR ROGER DE COVERLEY series, raised in English letters a new standard of literary grace and distinction. 2. A London weekly periodical, founded 1828, in which appeared articles on art, literature, society and politics.

SPECTER, a ghost or wraith. *See* GHOST.

SPECTOGRAPH. *See* SPECTROSCOPY.

SPECTRA, STELLAR, may be obtained by photographing a star with a telescope through a prism placed either directly in front of the object glass or at the eye-end in combination with a slit. In the former case the spectra of a large number of stars may be obtained at once. By the latter method only one spectrum at a time can be secured, but the spectrum is much larger and can be measured with much greater precision. It is possible also, in this method, to photograph on the same plate the spectrum of a terrestrial source and thus provide a standard for the determination of the RADIAL VELOCITY.

Great differences exist among the spectra of the stars but it has been shown that these are due almost entirely to differences in surface temperature. All the hundreds of thousands of stellar spectra that have been photographed may be arranged, with but few exceptions, in one continuous series of descending temperatures. At the upper end of this series are the

blue stars, so hot that all the atoms in their atmospheres are ionized, or stripped of their outer electrons, and unable to absorb much of the light coming from the stellar interior. Only a few dark lines are visible in these spectra, chiefly due to hydrogen and helium.

As a star gets cooler, the atoms of some of the other elements return to more normal states in which they can absorb light, and dark lines in the spectrum become more and more numerous. At first hydrogen becomes still more prominent, as in the white stars, such as Sirius. In yellow stars like the sun, iron begins to strengthen, while in the red stars like Antares even such compounds as titanium oxide become visible, and the whole spectrum is now crossed by such a multitude of dark lines, and has lost so much of its light in the violet that there is no remote resemblance to that of the blue stars.

Stellar spectra are classified into ten large groups, which had been assigned letters of the alphabet before the temperature sequence had been discovered. The letter O designates the hottest stars, while the others, following a scale in descending temperature are B for blue stars, A for white stars, F and G for stars similar to the sun, K and M for red stars. Some very red stars of peculiar behavior, and rather few in number, are classified in groups N, R and S.

The general appearance of a star's spectrum suffices for its classification. Further detailed analysis of the relative intensities of dark lines belonging to certain chemical elements such as strontium may then give an indication of the real luminosity of the star, and can thus be used for the determination of the PARALLAX.

W. J. L.

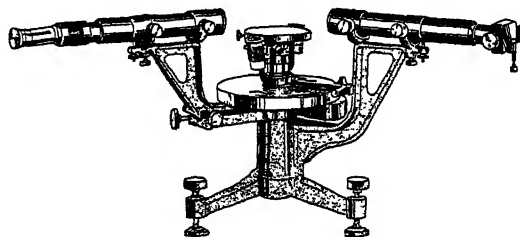
SPECTROHELIOGRAPH, an instrument designed specially for the photography of the sun. It consists of an ordinary SPECTROSCOPE, embodying an ingenious device of two slits and a moving plate which enable a photograph of the sun to be made in light of one particular wave length. Thus the observation of solar PROMINENCES may be made even without an eclipse. A similar instrument, designed for use in direct visual observations, is called the SPECTROHELIOSCOPE.

SPECTROMETER, an instrument for determining the index of REFRACTION, usually of some kind of glass in the form of a PRISM. The instrument may also be used as a SPECTROSCOPE, for examining the spectra produced by the prism.

The essential parts of a spectrometer are an accurately divided circle about whose axis a COLLIMATOR and TELESCOPE may be rotated. The prism rests upon a table which can be rotated about the axis of the circle. The collimator is a tube having an achromatic convex LENS at one end and a slit at the other end at the principal focus of the lens. Light from source placed before the slit is parallel after passing through the lens. It then traverses the prism where it is deviated so that it passes through the object glass of the telescope and forms a real image which is observed through the eye-piece. The

angular positions of the prism table and the telescope can be read upon the divided circle.

The measurements made with the spectrometer include A , the angle of the prism, and d , the angle of



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SPECTROMETER

minimum deviation of the light. From these, n , the index of refraction of the prism, is given by the relation

$$\sin \frac{A + d}{2} = n \sin \frac{A}{2}$$

It is found that d and, consequently, n increase with decreasing WAVE-LENGTH.

T. S.

SPECTROPHOTOMETER, an instrument by means of which the spectral distribution of an unknown LIGHT may be compared with that from a known source of light. Light from various sources usually consists not of a single wave-length but of various amounts of energy distributed through a wide range of wave-lengths.

All spectrophotometers have two essential parts: an apparatus, such as a SPECTROMETER, which disperses the two beams of light into their component wave-lengths and then permits a limited section of the SPECTRUM of each to be viewed and compared for intensity as in an ordinary PHOTOMETER; and a device for continuously altering the brightness of one or of both spectra in a known way until the intensities of the two, at any given wave-length, are equal.

Different types of spectrophotometers differ from one another in the way the light from the two sources is introduced for comparison and in the methods employed for varying the intensity of light to get a balance.

T. S.

SPECTROSCOPE, an optical instrument for forming and examining spectra (*see* SPECTRUM). A common form is the *direct-vision* type, which is usually small enough to be held in the hand. As a rule, this consists of a slit and a COLLIMATOR lens, followed by a set of three PRISMS cemented together, the two outer prisms being made of crown glass and the middle one of the dense flint glass. The angles of the prisms are such that the total deviation of the middle part of the spectrum is zero, but, due to DISPERSION in the middle prism, a spectrum is produced.

The *constant-deviation* spectroscopy is extensively used for accurate work. In it, a collimator and TELE-

SCOPE are permanently fixed at right angles to one another, and a prism of special form is rotated on a prism table by means of a screw. A drum attached to this screw gives the wave-lengths of the spectral lines as they move by the cross-hairs in the observing telescope. This type is especially useful when it is desired to isolate some one particular wave-length.

A SPECTROMETER may be conveniently used as a spectroscope. The parts of the spectrum produced by the prism may be brought in succession to the cross-hairs of the telescope by rotating this to the proper point. A DIFFRACTION GRATING may be used instead of the prism to produce the spectrum.

The merits of a given spectroscope are measured by its RESOLVING POWER, its dispersion and the brightness of the spectrum produced. Flint glass gives both greater resolving power and dispersion than crown glass. Increased brightness is obtained by increasing the aperture of the collimating lens and the size of the prism. See also SPECTROSCOPIC ANALYSIS; SPECTROSCOPY.

SPECTROSCOPIC ANALYSIS, recognition of chemical elements by means of the spectroscope. It is of two kinds, emission and absorption. In emission analysis the material to be analyzed is converted into an incandescent vapor by introducing it into a gas flame, an electric arc, a high tension spark or other source of high temperature or of intense electric excitation. Each element then emits LIGHT, made up of a group of discrete WAVE LENGTHS characteristic of that element. The SPECTROSCOPE, or spectrograph, spreads the rays out into a spectrum in which each separate wave-length produces a spectrum line, whose position is determined by that wave-length. Accurate measurement and comparison with the spectra of known elements serve to identify the lines and thus to reveal the composition of the material. Emission analysis is valuable because of its extreme sensitiveness, the merest traces of most constituents being detected with certainty. It was formerly used solely for qualitative analysis, but improvements in apparatus and close control of conditions of observation now make it possible, through measurements of line intensities, to use it for accurate quantitative analysis as well. It is finding extensive practical application in metallurgical and other industrial laboratories on account of the speed, certainty and completeness of its results.

In absorption analysis, light from a source giving a continuous spectrum is passed through the material and then examined with the spectroscope or spectrograph to determine what wave-lengths are transmitted and what are absorbed. From the wave-lengths of the absorption bands, much valuable information is gained as to the vibration frequencies of the component parts of the MOLECULES of the sample material and hence as to its structure. See also CHEMICAL ANALYSIS.

C. C. N.

SPECTROSCOPIC BINARY, a double star in which the two components are so close to each other that the binary character can be discovered only by means of the spectroscope. This shows the variation

in speed in the line of sight as the two stars circle around each other.

SPECTROSCOPY, the production and study of spectra. LIGHT passing through a PRISM or a DIFFRACTION GRATING spreads out into a series of component colors called a spectrum. If the light, after leaving its source, is not acted upon by any absorbing material (see ABSORPTION OF LIGHT; ABSORPTION SPECTRA), the series of component colors is termed an EMISSION SPECTRUM. Either one may be a LINE SPECTRUM or a BAND SPECTRUM. In addition, an emission spectrum may be continuous, consisting of neither lines nor bands.

Spectroscopy possesses two main aspects, theoretical and experimental. The theoretical aspect has developed for the most part during the 20th century. It is largely mathematical and includes line spectrum, band spectrum and X-RAY SPECTROSCOPY.

The experimental aspect of spectroscopy is older, dating from 1666, the time of NEWTON's famous discovery of the production of a spectrum by the action of a prism on sunlight. The same experiment may now be observed by the use of a SPECTROSCOPE, which consists of a prism or diffraction grating so mounted as to make the spectrum easily visible. If the instrument is arranged to facilitate photographing the spectrum, it becomes a *spectrograph*. If scales are attached to facilitate measurement of the angles of incidence and emergence of light, the instrument becomes a *spectrometer*.

The technique of experimental spectroscopy has developed along two principal lines, the production of spectra and the measurement of WAVE-LENGTH. In the latter, almost unbelievable precision has been reached. Measurements have been made in which various observers agree to eight significant figures, an accuracy of approximately one part in a hundred million. Measurements to seven significant figures, an accuracy of one part in ten million, are relatively common.

The technique of the production of spectra involves a great variety of experimental methods. Within the visible spectrum, with wave-lengths between 4,000 and 7,000 ÅNGSTRÖM UNITS, spectra are produced by prisms when conservation of light is of primary importance and when width of spectrum, or DISPERSION is of secondary importance; they are produced by diffraction gratings when the relative importance of these two factors is interchanged. But the principal occasion for variety of experimental methods in spectroscopy lies in the fact that the majority of the observations required by modern spectroscopy lie outside of the visible spectrum. GLASS, the principal material used for LENSES and prisms for work in the visible spectrum, is opaque to light of either longer wave-length, infra-red, or shorter wave-length, ultra-violet.

For the infra-red region of the spectrum, with wave-lengths of 7,000 to 100,000 Å., lenses and prisms are made of rock salt or of sylvite. For the visual and photographic methods used in the visible region for detecting the spectrum, some device must be sub-

stituted which is essentially a detector of small temperature differences. By these methods, wave-lengths as great as 3,000,000 Å., or 0.3 millimeter, have been detected, though the infra-red spectrum is usually considered to have 100,000 Å., or .01 millimeter, as a practical limit.

For the ultra-violet portion of the spectrum, 4,000 to 150 Å., different methods are used. Photographic emulsions (*see* PHOTOGRAPHY) are sensitive in this region, and the detection of ultra-violet always uses the photographic method. Since ultra-violet light will not penetrate glass, lenses and prisms must be made of other materials. QUARTZ is used for wave-lengths between 4,000 and 2,000 Å., and FLUORITE for wave-lengths shorter than 2,000 Å. Concave diffraction gratings are very commonly substituted for lenses and prisms for these wave-lengths. Moreover, since ultra-violet of shorter wave-length than 2,000 Å. will not penetrate even air, the entire optical system must be enclosed in an evacuated container. Such an apparatus is termed a *vacuum spectrograph*. The gelatine of the ordinary photographic emulsion is impervious to these short wave-lengths, and especially made plates called *Schumann plates* are required in vacuum spectrographs. L. W. T.

SPECTRUM, LIGHT, an image formed when LIGHT is passed through a glass PRISM. Ordinary light is composed of light of different colors, or wave-lengths. The action of the prism is to refract (*see* REFRACTION) the light of different wave-lengths to different degrees, so that each color appears separately. Monochromatic light, of course, forms no spectrum. Inasmuch as different substances produce characteristic spectra, spectral analysis is an important field of modern science. For complete information *see* SPECTROSCOPY; ABSORPTION SPECTRA; EMISSION SPECTRA.

SPECULATION, a word of many definitions. In a narrow sense speculation means assuming a money risk for the purpose of making a profit. Such risks are undoubtedly the part of nearly all if not all business ventures, the degree of risk depending upon the ability of the speculator to guess the risk and to foresee future developments. The merchant who buys goods to sell at a profit undoubtedly assumes a speculative risk because of his uncertainty as to what future prices will be. In the stock market, speculation is popularly associated with the buying of stocks on margin and while in some cases such speculation may have all the aspects of gambling, in other cases the circumstances surrounding speculative activities remove such activities beyond any association with common gambling. The stock speculator may be divided into four classes consisting of the professional speculator, the amateur speculator, investors and the public. There is wide variation in the speculative risks assumed by the members of these classes. The risk of the professional stock speculator, following closely all market factors, is small in proportion to that of the amateur who dashes into the market with little or no ability to gauge conditions. The difference between investment and speculation is determined by safety.

SPECULUM METAL. *See* TIN.

SPEECH, FIGURES OF. *See* FIGURES OF SPEECH.

SPEECH, PSYCHOLOGY OF, a science describing the process by which articulate speech and language expression are developed both in the race and in the individual. Speech is a means of communication. In its earliest stages it is prelinguistic, consisting merely of laryngeal utterances. The vowel sounds are laryngeal formations; with the formation of consonants speech becomes more articulate. There are several theories for the origin of speech, such as the gesture, the interjectional, the onomatopoeic and the social behavior theories. In any case speech has its social implications and is a means of controlling social behavior. Speech is a vocal gesture that has distinct advantages over other types of gesture. No doubt all the above-mentioned theories have played their part in the development of language. Many words have become identified with objects accidentally, but with the development of intelligence and the growth of experience the process of identification has been greatly furthered by conscious intent.

SPEECH DISTURBANCES: Stammering. *See* STAMMERING.

SPEEDOMETER, an instrument for indicating the speed of a MOTOR VEHICLE; usually combined with an odometer which registers the distance traveled. A flexible shaft, connected with the wheels or transmission shaft, drives the indicating mechanism which generally consists of: 1. A "fly-ball" governor connected through LINKAGES to an indicator; or 2. A magnetic element that "drags" a light metallic cylinder or a cup, causing it to turn about its axis against the restraining influence of a spring. *See* MAGNETIC INDUCTION. A less common type is based on the fact that speed is *distance* divided by *time*. This instrument requires an odometer to measure the distance traveled, a clockwork, and a mechanism to effect the division. It is complicated and seldom used, as likewise is the instrument based on the principle of a MAGNETO, which indicates the speed of its rotation on a voltmeter. *See also* TACHOMETER.

SPEEDWELL, the common name for a large genus (*Veronica*) of herbs, shrubs or rarely trees of the figwort family. There are about 200 species found widely in temperate and cold regions but infrequent in the tropics. Many are grown as garden ornamentals; a few are used medicinally. They are mostly low plants with opposite stem leaves and alternate floral leaves, and numerous small, mostly blue, pink or white flowers. Of some 20 species found in North America about one-half have been introduced from the Old World. Among the best known are the common speedwell (*V. officinalis*), the purslane speedwell (*V. peregrina*), the thyme-leaved speedwell (*V. serpyllifolia*), the corn speedwell (*V. arvensis*), the field speedwell (*V. agrestis*) and the ivy-leaved speedwell (*V. hederifolia*). The cultivated speedwells include many shrubby species, natives of New Zealand. *See* VERONICA.

SPEICHER, EUGENE EDWARD (1883-), American painter, was born at Buffalo, N.Y., Apr. 5, 1883. He studied in Buffalo, N.Y., and abroad, specializing in portraits and landscapes; he was elected to the National Academy in 1927. Speicher's canvases include *Morning Light*, in the Metropolitan Museum, New York; *Mlle. Jeanne Balzac*, Cleveland Art Museum; *Portrait of a Girl*, Phillips Memorial Gallery, Washington, D.C.; and portraits of Col. Charles Clifton and Katherine Cornell, Albright Art Gallery, Buffalo.

SPEKE, JOHN HANNING (1827-64), British explorer, was born at Jordans, Somersetshire, May 4, 1827. In 1844 he joined the Indian Army and while in India had an opportunity to explore the Himalayas and to visit Tibet. In 1856 he joined Sir Richard Burton's expedition into the interior of Africa. In 1860-63, hearing reports from Arab traders that there were several large lakes in the interior, he organized an expedition and found Lake Victoria Nyanza from which he followed the Nile down into Egypt. In 1863 he published his *Journal of the Discovery of the Source of the Nile*, and is also the author of *What Led to the Discovery of the Source of the Nile*. He was accidentally killed while hunting, Sept., 1864.

SPELLING, representation of words in writing by some form of ALPHABET. The earliest known system was syllabic, representing not letters but syllables, as in Cyprian, where GREEK *ton argyron*, "the silver," was written *to na ra ku ro ne*, or as in SANSKRIT, where each consonant-letter, unless specifically marked otherwise, carries with it the vowel *a*. All genuine SEMITIC alphabets record only the consonants (e.g., ARABIC *yakubna*, "ye (feminine) will write" is written *yktbn*), though later various marks were placed above or below the letters to indicate vowels, especially in sacred books, such as the Bible and the Qu'rān.

Theoretically, each alphabet should have as many signs as there are sounds in the language or languages which it records; and deductions of worth may be drawn from the presence or absence of signs for given sounds (Cypriote, as implied above, evidently had no sound *g*). Practically, however, this would require some 60 signs for every language (see PHONOLOGY); and no language actually finds more than its most salient signs represented in script. When an alphabet is extended from its original language to represent the sounds of others, it becomes still more inadequate, so that new signs must be invented as in the development of the SLAVIC alphabets from the Greek, or modifying marks must be placed over characters to indicate their new values (as German *ä, ö, ü* where *e* stands for a minute *e*). The same letter may have different values in the same language, as *s* in English *cat-s, dog-s, plea-sure*, or in different languages, as *z* in English *zero*, German *zehn* (*ts*), Greek *háxomai* (*dz*), Spanish *mozo* (*th* in *th-is*). In transcriptions from one alphabet to another, the principle must be one character for each character in the original alphabet. It thus becomes necessary to place various dia-

critical marks over, under, or in the alphabet into which transcription is made, to borrow characters from other well-known alphabets, to invert letters or employ capitals, or to invent new conventional signs. In this way various "phonetic alphabets" have been devised with the object of including all known sounds; and these have proved of great value in the scientific investigation of language, though necessarily subject to constant amendment.

As actually found, spelling is of two types, historical and phonetic, with every degree of mixture of the two. All earliest records, as in Greek, were meant to be phonetic, though in fact their representation of the actual pronunciation seems to have been faulty. With the evolution of a language, its pronunciation changes, but spelling, being essentially conservative, tends to retain the old form, thus no longer giving the pronunciation of the period, so that from time to time efforts may be made to reform the spelling. Italian spelling is reformed as contrasted with French, whereas the spelling of IRISH or of TIBETAN give no idea whatever of their pronunciation to-day. Historical spelling possesses a distinct advantage in that it gives valuable information regarding the origin of the words which it records, this information being lost in purely phonetic spellings, e.g., English "through" (German *doch*) as contrasted with the meaningless "thru," or English "honour" showing its derivation from the French (cf. *honneur*) as contrasted with American "honor," which falsely implies derivation directly from Latin. The change of the type of "honour" to "honor" was actually due to an exaggerated nationalism!

Various efforts have been made to create a "simplified spelling," and one cannot deny that English, French and other spellings are not representative of their actual pronunciations. On the other hand, it is noteworthy that few scholars of deep attainment in linguistics have ever favored the movement, which seems essentially based on purely superficial utilitarianism, and which must, in its turn, be "simplified" as pronunciation changes, giving in the long run a confusion even worse, and far less explicable, than that which now prevails.

L. H. G.

SPELT, a variety of wheat (*Triticum aestivum* var. *spelta*) with slender, loose, bearded ears bearing small triangular grains. Anciently spelt was one of the more common kinds of WHEAT, grown especially in poor soils, but its cultivation is now relatively unimportant.

SPENCE, THOMAS (1750-1814), British sociologist, was born at Newcastle on Tyne, June 21, 1750. In 1793 he published *The Meridian Sun of Liberty*, outlining a system of land nationalization. He became a bookseller in London, where he was twice imprisoned for libel. His followers formed the Society of Spencian Philanthropists. He died at London, Sept. 8, 1814.

SPENCER, HERBERT (1820-1903), English philosopher, was born at Derby, Apr. 27, 1820. Declining the opportunity of a university education, he was

self-educated. From 1831-46 he was engaged in engineering, and from 1848-53 was sub-editor of the *Economist*. In 1860 Spencer announced his plan for a work on *Synthetic Philosophy* to be complete in 10 volumes. His *First Principles*, the key to the system, appeared in 1862. This was followed by *Principles of Biology*, 2 vols., 1864-67; *Principles of Psychology*, 2 vols., 1870-72; *Principles of Sociology*, 3 vols., 1876-96, and *Principles of Ethics*, 2 vols., 1879-92. Besides these titles should be mentioned his essays on *Education*, 1861, and *Progress*, 1858. Spencer died Dec. 8, 1903.

In his *First Principles* Spencer divided the universe into the unknowable and the knowable. Although he got into many difficulties with his discussion of the former, it would nevertheless appear that he knew too much about the unknowable. As knowledge advances, science continually encroaches on the realm of religion, but there is always an unknowable force beyond. Starting with such scientific axioms as the persistence of force, the conservation of energy, and the indestructibility of matter, in his discussion of the knowable, Spencer systematically built up his conception of evolution. This he finally put forth in his famous definition: "Evolution is the integration of matter and the concomitant dissipation of motion during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity, and during which the retained motion undergoes a parallel transformation." Dissolution is the opposite of this process, the dissipation of matter and the disintegration of motion.

Other characteristic Spencerian teachings are a *laissez faire* individualism, the theory of the origin of religion in ghost phenomena, intellectual and emotional differences between primitive and modern man, the conception of life as a process of adjustment between external and internal factors, acceptance of the Lamarckian (see LAMARCK, JEAN) theory, the idea of the survival of the fittest, and HEDONISM in ethics.

SPENCER, ROBERT (1879-), American landscape painter, was born at Harvard, Neb., Dec. 1, 1879. He was a pupil of Chase, Du Mond, Henri and Garber, and has exhibited throughout the United States, also at Toronto, Canada, and London. He became a National Academician in 1920. Spencer's paintings include *Repairing the Bridge*, in the Metropolitan Museum, New York; *The Hucklester Cart*, Art Institute, Chicago; *The Red Boat*, Corcoran Gallery, Washington; and *The Tower*, Carnegie Institute, Pittsburgh.

SPENCER, a city in northwestern Iowa, the county seat of Clay Co., situated on the Sioux River, 100 mi. northeast of Sioux City. Interstate buses and two railroads afford transportation. The countryside produces farm crops, sugar beets and live stock. The city has cement product factories and automobile accessory and machine shops. Spirit Lake and Okaboji Lake are in the vicinity. Lost Island Lake and State Park are near by. Spencer is noted locally for its county fairs. Pop. 1920, 4,599; 1930, 5,019.

SPENCER, a town and village in Worcester Co., central Massachusetts. The village is situated near Seven Mile River, about 12 mi. southwest of Worcester; it is served by the Boston and Albany Railroad. The town has shoe, woolen goods and wire factories. Under one roof in Spencer were born William Howe, inventor of the Howe truss bridge; Tyler Howe, maker of the first spring bed; and Elias Howe, Jr., who invented the sewing machine. The town was founded in 1721; incorporated in 1753. Pop. 1920, 5,930; 1930, 6,272.

SPENGLER, OSWALD (1880-), German social and political philosopher, was born at Blankenburg, May 29, 1880. He studied philosophy, mathematics and art at the universities of Halle, Munich and Berlin. Spengler is best known for his philosophy of history, which he worked out in *The Decline of the West*, 1918-22. He expressed a belief that civilization moves in cycles, and that western culture has entered upon its period of decline. The World War gave him much ammunition for this viewpoint which he was able to exploit quite successfully. A fatalistic attitude toward the waxing and waning of civilizations is adopted. Spengler is the author of *Preussentum Sozialismus*, 1920, *Pessimismus*, 1921, and *Politische Pflichten der Deutschen Jugend*, 1924.

SPENSER, EDMUND (c. 1552-99), English poet, son of a journeyman clothmaker, was born in London, probably in 1552. He attended the Merchant Taylors' school on a grant from a charitable fund and with similar help spent seven years at Cambridge University, receiving his master's degree in 1576. Training himself to be a poet, he read widely in Greek, Latin, Italian and French, and included in his studies and interests all phases of the intellectual activities of the time. For a few years his movements are uncertain, but in 1579 he was in London, where he published *The Shepherdes Calender*, a collection of 12 pastoral eclogues. The next year Spenser went to Ireland as secretary to Lord Grey de Wilton and on Grey's recall in 1582 remained there, holding minor offices, and obtaining in 1586, under the government scheme for the plantation of Munster, the perpetual lease of Kilcolman Castle, County Cork, with 3,000 acres of land. SIR WALTER RALEIGH visited him there in 1589 and took him to London for presentation to Queen Elizabeth and publication of *The Faerie Queene*, upon which Spenser had been working for ten years. It won great favor immediately and thrilled all England with the realization that here was the long desired national epic. Spenser's fame as a poet rests mainly upon this poem, which is at once a romantic narrative, a treatise on the qualities of the ideal man and a national epic to the glory of England as personified in Elizabeth, written in a verse of his own invention, the Spenserian stanza (see STANZA). Among his other works are *Colin Clouts Come Home Againe*; *Complaints*; *View of the Present State of Ireland*. Kilcolman Castle was burned in Desmond's rebellion in 1597 and Spenser, having returned to Ireland, fled to Cork. He was sent with dispatches to

London where he died Jan. 16, 1599, and was buried in Westminster Abbey.

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SPERM WHALE (*Physeter catodon*), the type species of the suborder of toothed whales (*Odontoceti*). It differs from the other suborder, the whalebone whales, in having functional teeth in the lower jaw alone, and in possessing spermaceti. Sperm whales exist in all oceans, but are most numerous in the tropics. They are of immense size, sometimes reaching a length of 80 ft. The head is enormous and nearly square in front, with the mouth underneath and a single blowhole above. A great space above the skull is filled with a mass of fluid fat called spermaceti, sufficient to fill several barrels; this is used in making candles, and the thick layer of blubber beneath the skin yields the sperm-oil of commerce. Because of these valuable products, and the ambergris found in the intestines, this whale has been the object of pursuit for many years, in consequence of which, it has now become rare.

Sperm whales feed mainly on squids and cuttlefishes, including the gigantic squids of arctic seas, for which they must dive very deeply. They battle constantly among themselves, are quick-tempered, and often attack and destroy the boats of whale-hunters. A pigmy sperm whale (*Kogia breviceps*) is found in warm seas. A group, containing many species of comparatively small size, and with gregarious habits, known as the beaked or ziphioid whales, occurs chiefly in the South Pacific; these are of slight commercial importance.

E. I.

SPERRY, ELMER AMBROSE (1860-1930), American electrical engineer and inventor, born at Cortland, N.Y., Oct. 12, 1860. From 1876 to 1879 he was a student at the Cortland State Normal School, and at Cornell University in the academic year 1879-80. In 1880 he founded the Sperry Electric Works in Chicago. He was also the founder of the Sperry Electric Railway Company of Cleveland, 1894, and the Sperry Gyroscope Company of Brooklyn, 1910. Among his inventions are a gyro-compass, the highest intensity searchlight, and a compound internal combustion engine. Sperry took out upwards of 400 patents. He was responsible for the erection of the Chicago beacon on the shore of Lake Michigan. He died at Brooklyn, June 16, 1930.

SPEYER or **SPIRES**, capital of the Rhine-Palatinate of southwestern Germany, located on the Rhine River about 11 mi. south of Mannheim. Despite its age, it has few ancient buildings. Most noteworthy of its six churches is the cathedral begun by Conrad II in 1030 and finished in 1061 by Henry IV, who added the Afra Chapel in 1604. It contains the graves of eight German emperors and of Beatrix, wife of Frederick I Barbarossa. Three times it suffered by fire, and in 1689 it was almost entirely destroyed by the French, who opened and desecrated the emperors' graves. It was rebuilt in 1772-84, and again demolished and rebuilt in 1822. There are remains of a few secular buildings; a new museum

is located here. The chief products are cotton goods, machines, cigars, celluloid and iron ware. The city trades in tobacco, leather, cattle, skins, lumber, grain and wine. The Roman *Noviomagus*, it bore the name Spira after the 7th century. Speyer was an imperial city in the 13th century and, after various vicissitudes, became Bavarian in 1815. Pop. 1925, 25,906.

SPEYER, DIETS OF. The Diet of 1526 dealt chiefly with the Lutheran question. The international situation was peculiarly favorable to the reformers. The emperor, with his hands tied by an alliance against him of France and the pope, was compelled to seek the aid of the Lutherans by a policy of conciliation, and therefore proposed through his representative that the religious question be referred to a general council of the church, an ancient weapon for the embarrassment of popes. The Diet decreed that until the meeting of such a council each prince should so conduct himself that he might be able to answer to God and the emperor. This was a foreshadowing of the territorial principle. The result was, of course, the extension of Lutheranism.

At the Diet of Speyer in 1529 the international situation had entirely changed. The pope and the emperor were no longer at war and the reformers no longer so solidly united. The majority of the Diet rescinded the action of the previous assembly and decreed that, although Lutheranism was not to be exterminated where already established, there should be no further innovations, Catholics should be tolerated in Lutheran territory, but not the reverse; Zwinglianism should not be tolerated anywhere, and the Anabaptists should be put to death. The reformers submitted a protest from which the name "Protestant" is derived. This was not a plea for religious liberty, but merely for the recognition of Lutheranism. The protest expressly approved of the action against the Anabaptists.

SPEZIA, also **LA SPEZIA**, a port of northwestern Italy, capital of Spezia province, situated at the northwest angle of the Gulf of Spezia, at the foot of beautiful hills crowned with forts. The gulf, one of the largest and safest harbors in the Mediterranean, has been the leading naval port of Italy since the establishment of the united kingdom. The harbor has been enlarged since 1927 and has increased steadily in commercial importance. The industries of the city are shipbuilding and allied industries, canning and cable factories, jute spinning, cultivation of grapes, and oyster dredging. Pop. 1931, 107,958.

SPHALERITE, called also "jack" and blende, the most important ORE of zinc. In color it is yellow, brown, to black, and varies from transparent to nearly opaque, with a resinous appearance. Sphalerite is zinc sulphide, crystallizing in the ISOMETRIC SYSTEM.

Deposits are found in both sedimentary and igneous rocks, but it is especially common in limestone. GALENA is its most usual associate, but CHALCOPYRITE, PYRITE, BARITE, FLUORITE, and SIDERITE are also found with it, and it often accompanies silver ores.

Missouri, Colorado, Montana, Wisconsin, Idaho, and Kansas are important sphalerite mining areas. See also ORE DEPOSITS; MINERALOGY.

SPHENE, a name usually applied to the lighter colored, yellowish or greenish, translucent species of the mineral titanite, a calcium titanium silicate. Although rather soft, these often make brilliant and attractive gems because of their high refractivity. Titanite is a common ACCESSORY MINERAL in certain IGNEOUS and METAMORPHIC ROCKS. Sphene is found in Switzerland, the Tyrol, and other European localities, and in Maine, New York and Pennsylvania. See also GEM STONES; PETROLOGY.

SPHENOPHYLLS, a family of slender and graceful fossil plants which disappeared toward the close of Paleozoic time, leaving no direct descendants. Rosettes, or whorls, of wedge-shaped leaves attached by their points, cluster at the joints of the rather weak-ribbed stems, which may have climbed, liana-like, about the trees of Coal Measure forests. Sphenophylls are of special interest as suggesting a common ancestor for still living groups of club-mosses and horsetails, with both of which they display anatomical affinities. The long, slender, spore-bearing cones externally resemble those of giant pithed CALAMITES. The wood of Sphenophyll stems, however, is solid.

SPHERE, in popular usage, a solid every point on the surface of which is at a given distance from a given point within the solid. The given distance is the radius, and the given point is the center. Any straight line passing through the center and terminated at both ends by the surface of the sphere is called a diameter. In modern mathematical usage the sphere is considered as the surface, and the volume of the sphere is defined as the volume inclosed by this surface. In ANALYTIC GEOMETRY the equation of the sphere is $x^2 + y^2 + z^2 = r^2$, the center being at the origin. If, however, the center is taken at some point (a, b, c) , the equation is

$$(x - a)^2 + (y - b)^2 + (z - c)^2 = r^2.$$

The area (S) of a sphere is given by the formula

$$S = 4\pi r^2, \text{ and the volume (V) by } V = \frac{4}{3}\pi r^3.$$

SPHERE OF INFLUENCE, a so-called backward state, or region within such a state, in which some westernized and industrialized power has secured preferential or exclusive rights to make loans, build railways, operate mines, and in general exploit the natural and commercial resources. Ordinarily the right to exercise a certain amount of political control or supervision accompanies the establishment of a sphere of influence, thus differentiating the latter from a sphere of interest which usually implies only priority in economic privileges. It is tacitly understood among diplomats that no third party is to acquire dominion within or establish a protectorate over another country's sphere of influence. The Anglo-Russian Accord of 1907 delimited a Russian sphere of influence in northern Persia, and a British sphere in southern Persia.

SPHERICAL ABERRATION, a term used to describe the failure of LIGHT from a point source to come to a focus after passing through an optical system of MIRRORS or LENSES. It is produced when the reflecting or refracting surfaces prevent the light rays from different areas of the spherical mirror or lens from coming to a focus at the same place. The aberration is greater when the distance of the portion considered from the center of the mirror or lens is greater. To keep spherical aberration to small values, mirrors and lenses in which the aperture is small compared to the focal length are used. See also ABERRATION IN OPTICAL SYSTEMS. P. I. W.

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SPHERICAL POLYGON, a portion of a sphere, or spherical surface, bounded by three or more arcs of great circles, or lines of intersection of the spherical surface and a plane through the center of the sphere. A spherical polygon of three sides is called a spherical triangle. Among the properties of these figures may be mentioned the following: The sum of the sides of a spherical polygon is less than 360° . The sum of the angles of a spherical triangle is greater than 180° and less than 540° .

There is another interesting property relating to polar triangles. The ends of the diameter of a sphere perpendicular to the plane of a given circle on this sphere are called the two poles of this circle. Given a spherical triangle ABC , let A' be the pole of the circle BC such that A' and A lie on the same side of BC . Let B' , C' be the analogous points for the circles CA , AB . The spherical triangle $A'B'C'$ is called the polar triangle of ABC . It may be shown that ABC , in turn, is the polar triangle of $A'B'C'$. Furthermore, any angle of either of two polar triangles is the supplement of the opposite side of the other, that is, remembering that both angles and arcs are measured in degrees, $\angle A + \text{arc } B'C' = 180^\circ$. N. A. C.

SPHEROID, a figure generated by an ellipse rotating about either axis. If the major axis is taken, the figure is a prolate spheroid; if the minor axis, an oblate spheroid. The equation of the former is

$$b^2x^2 + a^2(y^2 + z^2) = a^2b^2;$$

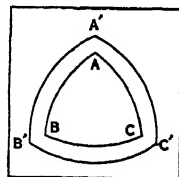
of the latter,

$$b^2(x^2 + z^2) + a^2y^2 = a^2b^2.$$

The spheroid is a special type of the ELLIPSOID.

SPHINX. 1. In Greek mythology, a monster which had the body of a lion, the head of a woman, the wings of a bird, and the tail of a snake. In the legends of OEDIPUS, the riddle of the Sphinx plays an important part. 2. The monumental Great Sphinx of Giza, Egypt, almost 70 ft. high, supposed to have a magical effect against the powers of evil. See also GIZA; EGYPTIAN ARCHITECTURE.

SPHINX MOTH, a popular name for moths of the family *Sphingidae*, also called hawk-moths. The caterpillars when at rest rear the fore part of the



body upward, curl the head down, and sit motionless. In this position they are thought to resemble the Sphinx. See HAWK MOTH.

SPICA (*Alpha Virginis*), the brightest star of the constellation VIRGO. It is blue in color, very hot and is composed of two stars, 900 and 600 times brighter than the sun, respectively, revolving around each other in 4 days at a distance of some 8 million miles. Their distance from the earth is 230 light years. See STAR: map.



SPHINX ON A COLUMN
From a vase in the Oesterreich
Museum, Vienna, Austria

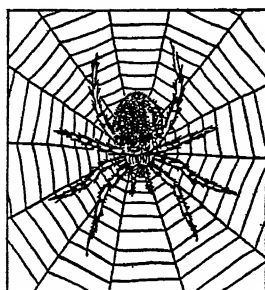
SPICE BUSH (*Lindera Benzoin* or *Benzoin aestivale*), a graceful shrub of the laurel family called also

Benjamin bush, found in the eastern United States and Canada. It grows 4 to 20 ft. high with spicy, aromatic bark, fragrant entire leaves, bright yellow flowers in clusters appearing before the leaves, and red, somewhat oblong fruits (drupes) ripening in late summer. The dried fruit is sometimes used as spice.

SPICE ISLANDS. See MOLUCCAS.

SPICES. The flavor and pungency of most spices is due to their volatile oils, for example, oil of cloves, oil of mustard, etc., and sometimes to other substances as well, such as the alkaloids "piperine" in black and white pepper, and "capsicine" in cayenne pepper.

SPIDER, the popular name for members of an arachnid order (*Araneæ*), found wherever insects, upon which they live, occur. There are many species, ranging in size from tiny creatures which are barely visible, to a giant bird-catching spider (*Theraphosa leblondi*) 3½ in. long. Many are protectively colored, so that they match their normal background; others, species of a genus (*Lathrodectus*) reputed to be very poisonous, are apparently so colored as to furnish warning of their presence. The bodies of spiders are divided into two parts, a large, sac-like abdomen and a head-thorax. Like other arachnids they can easily be distinguished from insects, to which they are but distantly related, by their possession of four pairs of legs. For feet they have small toothed claws, which enable them to walk upside down. Their most characteristic features are their poison glands and fangs, and their silk glands and spinning organs, or spinnerets. The poison is used to paralyze their prey. Relatively few species can penetrate anything so tough as human skin, but the bite of some, especially the larger ones, is often very painful and may occasionally be fatal to man. Their silk is put to a great variety



GARDEN SPIDER

of . Some spiders build complicated wheel webs to catch insects and many others make simple sheet webs. The trapdoor spiders line the burrows, which they dig in the ground, with silk, and make silk doors, which are sometimes so ingeniously hinged that they close automatically. The European water spider (*Argyroseta aquatica*) lives in a silken diving bell. Two spiders, the handsome *Dicrostichus magnificus* and *Glavomela*, make silken lassos, with a gluey drop at their ends, which they swing to capture their prey. Spiders can also use their silk for life lines, if they lose their footing on a difficult journey, and in all cases it is used to make their egg cocoons.

Some female spiders hang the cocoons in a safe place; others carry them wherever they go. In courting the male approaches the female with great care, for she is nearly always larger than he, and if she is not in the right mood to receive him she sometimes makes a meal of him. See also TARANTULA.

SPIDER FLOWER, the common name for several plants with flowers producing long threadlike stamens. The cultivated cleomes, especially *Cleome spinosa*, a native of tropical America sparingly naturalized in the eastern states with showy rose-purple or white blossoms, are known as spider flower. The name is applied also to species of *Tibouchina*, particularly *T. semidecandra*, an ornamental Brazilian shrub, grown for its large purplish flowers.

SPIDERWORT, a genus (*Tradescantia*) of perennial herbs of the spiderwort family (*Commelinaceæ*). There are 35 species native to tropical and temperate North America, about half of which occur in the United States; several species are grown as ornamentals. They are somewhat mucilaginous plants with abundant sap, long narrow leaves and showy, usually blue or purplish flowers borne in leafy umbels. The common spiderwort (*T. virginiana*) native to rich soils in the eastern United States, is often cultivated. See also WANDERING JEW.

SPIKE GRASS, the name given to various maritime and salt marsh grasses with more or less conspicuous flowering spikes, among which are the clustered spike grass (*Diplachne fascicularis*), the beach spike grass or sea oats (*Uniola paniculata*) and the marsh spike grass (*Distichlis spicata*). See also ALKALI GRASS; SALT GRASS.

SPIKENARD, an East Indian aromatic plant (*Nardostachys jatamansi*) of the valerian family with very fragrant rootstocks. It is thought to be the source of the perfumed ointment called spikenard, highly prized by the ancients, frequently mentioned in the Bible as rare and costly. The American spike-



JUMPING SPIDER
Attus sp.

nard (*Aralia racemosa*) is a vigorous woodland perennial of the aralia family with a pungent aromatic root possessing properties similar to sarsaparilla, used in medicine.

SPILLWAY, usually a section at the end of a DAM provided with sluice gates which may be opened to let out the surplus or flood waters. Flood waters are thus confined to a canal around the side of the valley, or if the valley is in rock, the water may be "spilled" and reach the original stream bed again below the dam. The dam may be of the "overflow" type, acting as a spillway all along its crest. If the rock below the dam is not hard, a concrete "apron" must be used to protect against "back wash." The *Chanoine* dams on great rivers have a series of folding wickets, which when lowered, makes the whole dam into a spillway for the passage of flood waters.

SPINACH (*Spinacia oleracea*), a fleshy-leaved annual of the goose-foot family, extensively grown as a potherb. The plant, which is unknown in the wild state, is believed to have been originally a native of western Asia brought into cultivation in ancient times by the Persians. In India and China spinach has been used as a vegetable for many centuries; in Europe the plant has been grown less than 500 years. It is a low, smooth herb, 6 in. to 2 ft. high, with a slightly branched stem which produces in cool weather a crown of large, tender, succulent leaves, the spinach of the markets. The plant bears small greenish flowers, the staminate in narrow leafless spikes, the pistillate in axillary clusters, and a spiny capsule-like fruit containing the seeds. Spinach, which is grown both as a fall and spring crop, is of easy culture thriving in any rich, well-drained soil. There are several important varieties, including the round-leaved, the Viroflay and the round-seeded. Since about 1900 spinach has greatly increased in popularity in the United States and is now the leading potherb. In 1927 the commercial crop of spinach marketed fresh amounted to 13,524,000 bu., valued at \$6,896,730; of this total Texas contributed 47%, Virginia 15%, California 6½%, and Maryland 5½%. In the same year 56,000 tons were produced for canning, of which 83% was grown in California.

The statistics for the years 1927-30 are as follows:

SPINACH, COMMERCIAL PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Acreage	Production (Bu.)	% of Tot. Prod.
UNITED STATES	47,123	13,169,000	100.0
LEADING STATES:			
Texas	24,690	6,409,000	48.6
Virginia	7,695	2,404,000	18.3
New Jersey	4,800	1,408,000	10.7
California	1,290	1,000,000	7.6
Maryland	1,410	441,000	3.3
Missouri	1,265	385,000	2.9

SPINAL COLUMN, SURGERY OF. Surgery of the spinal column includes all of the operations on the vertebral column and on the inclosed spinal cord performed for the purpose of removing pressure

on the spinal cord, altering the strength and shape of the vertebral column, and relieving pain in the extremities by dividing nerve tracts.

The spinal cord is composed of nerve tracts and fibers running longitudinally, in much the same manner as wires in a telephone cable. Certain diseases in which the spinal cord undergoes degeneration are not benefited by operation. Congenital or developmental defects, such as spina bifida (clef of the vertebral column), are amenable to operation only in certain cases. In some diseases which affect the vertebral column, there is an overgrowth of bone, producing a deformity, which can be corrected by surgery. In other diseases, the spinal column is affected by softening which alters its shape and strength; among the latter conditions, the most common is spinal caries or tuberculosis, in the treatment of which two operations have been devised for strengthening the vertebral column. One of these operations consists of the insertion of a bone splint into the spines of the diseased vertebrae, and the other consists of a splitting and fusing of the spinous processes and laminae (parts from which the spinous processes extend) to produce a mass of bone which will lock the vertebrae together.

Spinal Injuries. The success of operations for injuries of the spinal cord resulting from broken necks, broken backs, and gunshot and stab wounds depends upon the amount of injury to the spinal cord at the time of the accident. Injuries to the cervical or neck region may be due to a blow on the head, as a result of diving into shallow water or being thrown from a fast moving vehicle, while sudden blows on the shoulders, causing the body to bend quickly, result in fracture in the lower thoracic and upper lumbar regions. The bodies of the vertebrae can be broken and compressed without injury to the spinal cord. When the cord is injured, operation usually is carried out only if the spinal cord has not been completely crushed. In doubtful cases, a period of observation is generally allowed, to determine if partial function is retained and X-ray examination is made for evidence of pressure on the cord. (*See also* NEUROSURGERY.)

Tumors of the Spinal Cord. Undoubtedly, the most satisfactory results obtained from operations on the spine are those for the relief of pressure on the spinal cord from tumor. A complete neurologic examination, as well as studies of spinal fluid and X-ray pictures, are used to make a diagnosis, and after the diagnosis has been established, operation is usually performed soon, for these growths are commonly outside of the cord, and can be completely removed with relief of symptoms. The operation is carried out by making a longitudinal incision over the spinous processes of the vertebrae and the spines and laminae are exposed by separating the muscles. It is customary to remove the spines and laminae from three vertebrae, but if greater exposure is necessary, more can be removed with safety. If the tumor lies outside of the cord and produces pressure on the cord, and if

it can be completely removed, the results are satisfactory, but if the tumor involves the cord itself, the results are not so striking. Following removal of laminae, the function of the vertebral column is fully regained.

Relief of Pain. Operations on the spinal cord are performed for relief of excruciating pains which sometimes occur in the trunk and extremities. These pains may develop following amputation, as a complication of spinal syphilis or hopeless cancer, or as the result of inflammation of the nerves. There are two types of operation which may be done for the relief of pain. One of these measures consists of division of the posterior nerve roots just before they enter the spinal cord, but the more successful surgical procedure for relieving pain is section of the pain-carrying fibers in the cord itself.

In addition, there are certain inflammatory conditions of the spinal cord which are greatly benefited by laminectomy. This is especially true if the condition is getting worse and is localized to a definite level of the cord. (*See also* NEUROSURGERY; ORTHOPEDIC SURGERY. W. McK. C.)

SPINAL CORD, part of the nervous system, extending from the brain through a canal enclosed in the backbone or vertebral canal to the lower part of the back. In diameter it is about as thick as the little finger.

The spinal cord is covered by three membranes, known as the dura mater, arachnoid and pia mater. The upper end of the spinal cord arises from the brain, the lower end of the cord is tapered, lying free in the coccyx. Thirty-one pairs of nerves are given

roughly the letter H. These columns are often called the horns, when they are seen in cross section.

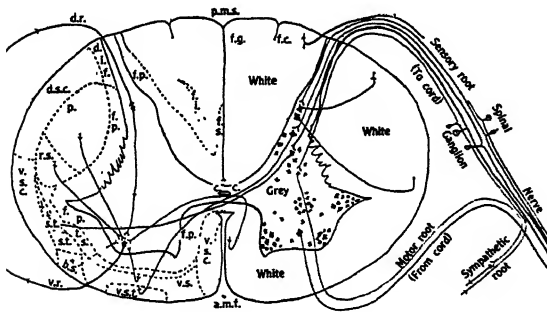
The white matter of each half of the spinal cord is subdivided by the columns of gray matter and nerve fibers from the nerves into portions called funiculi. These in turn are composed of nerve tracts, which are more or less distinct from one another. Some of them conduct sensory impulses to other levels of the spinal cord and to the brain, others carry impulses down from the brain which control the movements of the muscles. The ascending, sensory fibers, occupying the rear segment of the cord, carry impulses from the muscles, tendons and joints to the thalamus of the brain. Another group of fibers with a similar origin lie on the lateral extreme of the cord, but terminate in the cerebellum. Both of these fiber systems conduct impulses which furnish information concerning the movement of muscles and the position of members of the body. Another tract carries sensations of pain and temperature, while another mediates the sense of touch. The chief motor tract lies toward the side of the cord. It comes from the cortex of the brain and initiates movements of muscles. There are several other descending tracts which modify or initiate movements, but which arise from other parts of the brain. The white matter carries impulses both going to and coming from the brain. The two halves of the spinal cord are incompletely separated from each other, the fissure being quite distinct in the anterior part.

The spinal nerves are made up of two roots, called anterior and posterior. The anterior root carries motor impulses and the posterior root sensory impulses. The nerve fibers in the anterior root come from the gray matter in the anterior part of the spinal cord. The nerve fibers in the posterior root pass through the posterior horns of the gray matter.

The path of the nerve impulses comprising a reflex action is through the spinal cord. By a reflex action is meant the involuntary production of motor activity in some tissue in consequence of the stimulation of some sensory nerve fibers.

The simplest reflex arc must be made up of two units or neurons: a sensory neuron, the cell body of which lies in the small swelling on the posterior nerve root, known as a ganglion; and a motor neuron, whose nerve cell lies in the anterior horn of gray matter of the cord. The reflex arc, however, may be more complex. The sensory nerve fibers entering through the posterior root may pass upward through the entire length of the cord, and on the way give off a number of collaterals; or they may make connections with intermediate cells, which in turn are connected with one or more motor nerves.

In addition to the varied and important functions performed by the cord as a system of reflex centers controlling the action of numerous glands and internal organs as well as the voluntary muscles, it also is important as a pathway to and from the brain. The fibers, numbering more than a half million, that enter the cord through the posterior roots of the spinal



CROSS-SECTION OF THE SPINAL CORD

a.m.f., anterior median fissure; b.s., bulbospinal tract; d.l.f., dorsolateral funiculus; d.r., dorsal root; d.s.c., dorsal spinocerebellar tract; f.c., fasciculus cuneatus; f.g., fasciculus gracilis; f.i., fasciculus inter fascicularis; f.p., fasciculus proprius; l.s.t., lateral spinothalamic tract; p., pyramidal tract; p.m.s., posterior median sulcus; r.s., rubrospinal tract; s.t., spinotectal tract; t.s., tectospinal tract; v.c.s., ventral corticospinal; v.r., ventral root; v.s., vestibulospinal tract; v.s.c., ventral spinocerebellar tract.

off by the spinal cord. There are eight cervical, twelve thoracic, five lumbar, five sacral and one coccygeal.

The interior part of the spinal cord is made up of gray matter and the outer portion of white matter. The gray matter is in the form of two longitudinal fluted columns united across the center by a band called the central gray commissure, thus forming

nerves, bring in sensory impulses that may be continued upward by definite tracts that end in the brain. On the other hand, many of the impulses originating reflexly or otherwise in different parts of the brain are carried downward into the cord and thence to muscles through the anterior roots of one or another of the spinal nerves. The location and extent of these ascending and descending paths are most important practically in medical diagnosis. See also SYMPATHETIC NERVOUS SYSTEM. W. I. F.

SPINDLES, shafts usually of steel used in machines for holding or driving either the tools or the work to be done. Looms have spindles to hold the bobbins. LATHES have spindles to carry the CHUCK for holding the work and for supporting it at the rear. Some spindles are stationary while others revolve at high speeds.

SPINDLE TREE, the common name for a numerous genus (*Euonymus*) of woody plants of the staff-tree family, several of which are cultivated for their attractive fruits and foliage. There are about 120 species native to the north temperate zone, six of which are found in North America. They are mostly erect shrubs or small trees, though some are of creeping or climbing habit, with smooth, toothed leaves, small flowers in axillary clusters and scarlet or whitish fruits opening when ripe to disclose the bright orange-colored seeds. The tough, fine-grained wood of several species, especially the European spindle tree (*E. europæus*), is used for making various small articles.

SPINE, in botany, see THORNS.

SPINEL, a semi-precious mineral whose red varieties are sometimes confused with the RUBY, as indicated by their names, ruby spinel, balas ruby, and rubicelle. Blue spinel may be mistaken for SAPPHIRE. The spinel is nearly as hard as these forms of CORUNDUM. Other colors of spinel are orange, yellow, green, violet, brown and black and specimens vary from opaque to transparent. It is a magnesium aluminate, crystallizing in the ISOMETRIC SYSTEM. Spinel is found in such rocks as metamorphosed LIMESTONE, SERPENTINE, GNEISS and river gravels.

The deep red, transparent spinels are known as ruby spinels. Lighter colors are called balas ruby, and the rubicelle is orange-red to yellow. ALMANDINE is violet to purple, while the blue is called sapphirine. Chlorospinel is grass green. These colors are due to traces of such impurities as iron, chromium, cobalt and copper.

Gem spinels are found in gravels in Ceylon, Burma and Siam. They also come from Sweden and France and good specimens have been found in New York and New Jersey. See also GEM STONES.

SPINGARN, JOEL ELIAS (1875-), American literary critic, was born in New York City, May 17, 1875. He was educated at Harvard and Columbia universities, and taught Comparative Literature at Columbia in 1899-1911, becoming professor in 1909. He was a lieutenant-colonel in the United States Army from 1917-19. His publications include *A History of*

Literary Criticism in the Renaissance, 1899, *Creative Criticism*, 1917, and *Poetry and Religion*, 1924. Spingarn also edited the *European Library*, in 25 volumes, 1920-25.

SPINNING, in the broad sense, is the art of converting fiber into yarn, and includes the preparation of the fiber for the spinning machine by the processes of OPENING, PICKING, CARDING, COMBING, DRAWING, and ROVING. In the more restricted sense it is the operation in the production of yarn in which the final drafting and twisting take place, these operations being performed by the spinning machine. This machine performs three basic functions. It pulls the roving into a longer and more slender form by drafting or drawing out; it twists the extended strand in order that the fibers will be wound spirally around each other and will thus hold together; and it winds the yarn thus made into a portable package. Sometimes more than one roving are drafted and twisted into one yarn for the purpose of affording greater evenness. There are two distinctly different types of a spinning machine—the frame and the mule. Of the former there are three distinct sub-types—the ring, the cap, and the flyer.

All spinning frames draft the sliver by passing it through several pairs of rollers, each pair revolving faster than the pair before it. On the ring frame, popular for cotton (see COTTON MANUFACTURE), the spindle, which is vertical and located below and a little in front of the last pair of drafting rollers, is surrounded by a metal ring. A small metal loop, known as the traveler, is free to slide around the ring. The strand of fiber passes from the drafting rollers through a metal guiding eye located directly over the spindle, through the traveler, and on to the bobbin, which is on the spindle and turns with it. As the spindle revolves, it winds the yarn on the bobbin and pulls the traveler around the ring. Every revolution of the traveler inserts one turn of twist in the strand of fiber between the traveler and the drafting rollers. An up-and-down motion of the ring serves to distribute the yarn evenly over the length of the bobbin.

On the cap spinning frame, widely used for worsted (see WOOL: Wool Manufacture) the spindle is stationary and the tip fits into the bottom of an inverted cup, known as the cap. The bobbin, which surrounds the spindle, is revolved and is at the same time slowly raised and lowered inside the cap. The friction of the strand of fiber against the edge of the cap serves the same purpose as the traveler on the ring frame in affording the drag which permits twisting and winding on the bobbin. Cap spinning can be done at higher speeds than ring spinning, but the yarn it produces is not as smooth.

The flyer frame, popular for flax and used to a certain extent for worsted, employs an inverted U-shaped piece, known as the flyer. The center of this flyer rests on the tip of the spindle and revolves with it. The bobbin is revolved more slowly in the same direction and is made to rise and fall slowly

inside the flyer. The strand of fiber passes through a hole in the top of the flyer, winds down one arm, and hence passes to the bobbin. The flyer frame operates more slowly than either the ring or the cap frame, but makes a smoother yarn.

Whereas the spinning frame is a continuously operating machine, the mule performs its operations intermittently. The cotton and worsted types of mule employ drafting rollers similar to the frame. The woolen type drafts by pulling at one end of the strand of fiber stretched over a considerable distance and supported only at the ends. The spindle on the mule continually moves away from the source of the strand, pauses, and returns to the source. In the cotton and worsted mules the spindle inserts twist in the drafted strand during the entire outward movement and during the pause. In the woolen mule the strand of fiber is fed to the spindles during approximately half the movement, the spindle drafting this out during the remainder and twisting mainly during the pause. In most cases the yarn is wound into package form on the return movement of the spindle. The intermittent motion of the mule necessitates a slow rate of production, but the yarn made is of high quality.

E. D. F.

SPINOZA, BARUCH or (**BENEDICT**) (1632-77), Jewish philosopher, was born at Amsterdam, Nov. 24, 1632. He studied theology but early showed a liking for independent thinking. In 1656 he was excommunicated from the synagogue, and from this time on was persecuted by both Jews and Christians. In order to make a living he became a grinder of lenses. Moving from place to place in order to escape persecution, he finally settled at The Hague, where his most important works were written. Here he died Feb. 20, 1677.

Regarded as an atheist in his day, Spinoza has since become known as the God intoxicated man. It was not until long after his death that his philosophy began to exert a powerful influence. His *Tractatus theologico-politicus* was published in 1670 but *Ethics*, completed in 1675, was not published until after his death. Spinoza's philosophy is monistic. For him substance is all that there is. This substance is that which exists in itself and is conceived by itself. To substance he gives the attributes of thought and extension, thus becoming the founder of the double aspect theory. Pantheism also finds one of its best expressions in Spinoza.

SPIRÆA, a genus of small deciduous shrubs of the rose family many of which are planted for ornament. There are about 75 species native to the Northern Hemisphere of which some 12 occur in the United States. They are usually hardy vigorous shrubs, 3 to 8 ft. high, with alternate, sometimes pinnately lobed leaves and profuse, small, white, pink or reddish flowers borne in conspicuous clusters. Among the most popular ornamental species are the bridal wreath (*S. prunifolia*), native to China and Japan, and Van Houtte's spirea (*S. Vanhouttei*), one of the finest of spring-blooming shrubs, probably a hybrid between

two species native to eastern Asia. See also **HARDHACK**; **MEADOWSWEET**.

SPIRAL, a word meaning coil (Greek *speira*, a coil). It refers to various curves such as the spiral of Archimedes, with equation $r = a\theta$, or $\tan \phi = \theta$, one of a class of which the general equation is $r = a\theta^n$. The equation $r = ae^{k\theta}$, or $k\theta = \log \frac{r}{a}$, is

that of the logarithmic or equiangular spiral, a curve studied by Jacques (Jakob, James) Bernoulli (1692), who called it a *spira mirabilis*. The curve $r^2 = \theta$ is called the spiral of Fermat, he having proposed it in 1636. See **CURVES**.

SPIRE. See **TOWERS AND SPIRES**.

SPIRES. See **SPEYER**.

SPIRIT LAKE MASSACRE, a raid by the Sacs and Foxes of the Sioux tribes in Mar. 1857, on the white settlement at Spirit Lake, Dickinson County, Ia., in which 30 whites were killed and all their houses razed. The effect of the massacre was that immigration to northwestern Iowa was retarded for several years.

SPIRIT PHOTOGRAPHY. The appearance of additional faces or figures when a sitter posed for his photograph was offered as proof of spirit photographs by a photographer named Mumler in 1862. These spirit forms or faces were often recognized as those of deceased relatives. Fraud, generally double exposure, was detected from the outset and charges were brought in a court of law. Despite these charges in the United States and England, such photographs continued to be offered as evidence of spirit phenomena.

In 1923 **SIR ARTHUR CONAN DOYLE** published a volume of spirit photographs which he claimed as authentic and founded a society for the study of supernormal photographs. Even the handwriting of deceased persons appeared. Doyle likewise published photographic evidence of the existence of fairies. That all such photographs are fraudulently produced has been abundantly demonstrated.

J. J.

SPIRITS, the name for liquors distilled from fermented grape juice or molasses or from malted grains, such as barley, rye, maize, etc. Brandy is spirit distilled from wine. It usually contains 40 to 50% alcohol. Cognac is a fine grade of brandy. Rum is prepared by distillation of the product obtained by the fermentation of cane sugar molasses. It contains about 50% alcohol. Gin is spirit to which the volatile oil of juniper and sometimes other aromatic flavorings have been added. It contains about 30 to 45% alcohol. **WHISKY** is made by the distillation of fermented grain and colored and flavored by storage in charred barrels or by addition of caramel and suitable flavor. It usually contains 40 to 50% alcohol.

SPIRITUAL EXERCISES, a collection of religious meditations by St. Ignatius Loyola, written originally in Spanish and completed about 1548. St. Ignatius found the initial inspiration for this work in the *Exercitatorio de la vida Spiritual*, or *Spiritual Exercises*, published about 1500 by Abbot

Garcias di Cesneros. The meditations are divided into four series or weeks. Those of the first week are intended to purify the soul; those of the second to lead the reborn soul into the service of God; and those of the third and fourth weeks to support the soul in that service, fortifying it with precepts and fanning the flame of its divine love. Translated into many languages since its first appearance, the *Spiritual Exercises* has been one of the most inspirational books of the western world.

SPIRITUAL FRANCISCANS. Following the death of St. Francis of Assisi, in 1226, there gradually took shape within the order founded by him divergent tendencies regarding the manner of observing his rule. One group, the lax party, which was in the majority, was in favor of modifying the rigid rule; opposed to it was the strict party, which strove to observe the rule in its original severity in respect to poverty and simplicity. The latter group came to be known as Zealots, or Spirituals. With their extreme asceticism, the Spirituals combined a mysticism bordering on the fanatic. In the latter part of the 13th century, the rupture between the lax and strict parties widened, and led finally to the actual withdrawal from the Franciscan Order of three distinct groups: (1) the Spirituals of the Marches of Ancona, who seceded about 1274, under the leadership of Liberato, and later of Angelo da Clarena. Excommunicated by a Bull of Pope John XXII in 1317, they defied the pope and continued their existence under the name of *Fratricelli* (Little brothers); (2) The Spirituals of Provence, France, led by Pierre Jean Olivi, who received the favor of Pope Clement V when they argued their case before him at Avignon, 1310-12, but were declared heretics by John XXII, and were ruthlessly exterminated by the Inquisition; (3) the Spirituals of Tuscany, who withdrew from the order about 1309, and were excommunicated by John XXII in 1318. Despite the relentless persecution of the Spirituals, and their undoubted tendency toward schism, it was chiefly their efforts which eventually led to the reforms in the Franciscan Order culminating in the separation of the Observants from the Conventuals in 1517, through a Bull of Pope Leo X. See FRANCISCANS.

SPIRITUALISM, while referring to all varieties of the belief in the manifestation and communication of the spirits of the departed, is commonly used to designate the modern revival of the belief in 1848 through the rappings heard in a house in Hydeville, near Rochester, N. Y., in the presence of two girls, the Fox sisters, as mediums. From there the movement spread rapidly all over America and to Europe. Spirit seances were held everywhere, with the attendant raps and movements of tables, slate-writing, noises in cabinets, materializations, messages from the spirit world, and in due time SPIRIT PHOTOGRAPHY and trance-utterances and books of revelations of the future life. Churches of spiritualistic belief were organized with both a ritual and the reception of spirit messages.

Spirit belief is ancient, and primitive spiritualism presents all the essential phenomena of spirit-control,

communication, exceptional occurrences credited to spirit agency, and the power of the priest, or shaman, to summon the spirits of the dead. All this survives equally in ancient and medieval forms of occultism (see OCCULT), and NECROMANCY, as well as in the beliefs in GHOSTS and their return in haunted houses.

With the revival of interest stimulated by the Society for Psychical Research, 1882, and the Seybert Commission, 1888, in the scientific examination of such evidence, the phenomena have been more seriously examined. The enormous amount of fraud and trickery in the earlier, cruder phenomena was made evident, together with the credulity on which it preyed.

The physical phenomena of raps, movements of tables, materializations and spirit photographs may be set down as fraudulent, so general has been their detection. But even so simple a phenomenon as the lifting of a table aroused a world-wide attention as late as 1910 in the person of Eusapia Paladino, whose genuineness as a medium was vouched for by several groups of eminent examiners, and whose sponsors argued that she resorted to fraud in order to produce phenomena when conditions were unfavorable. A later form of physical phenomena resulted in the theory of ECTOPLASM; but the same reason holds for regarding these as fraudulent despite their acceptance by a few men of science.

The revelational phenomena of trance mediums stand on a different footing. This type of evidence it is difficult, at times impossible, to evaluate. It depends upon the revelation of private affairs of which apparently the medium could have no knowledge, including identification of experiences and mental habits of the departed. Independent revelations by different mediums providing supplementary verification have been attempted. Though some careful witnesses, with no bias for spiritualistic beliefs, have been convinced by such communications, there is so much of this material that is loose and irrelevant, that the great majority of psychologists regard it as of no greater cogency than the rest. Clearly much of it must be left without explanation.

A renewed interest in spiritualism followed the Great War, and was reenforced by Sir Oliver Lodge's account of his communications with his dead son, Raymond. Sir Arthur Conan Doyle's advocacy was likewise influential, though he accepted uncritically many phenomena of a fraudulent character. Mediumistic phenomena have become a prominent interest in PSYCHICAL RESEARCH as well as in their bearing on trance states. See ABNORMAL PSYCHOLOGY. J. J.

SPIRITUALS, members of a reform party within the Franciscan Order. The party seems to have arisen through an early tendency, among those who favored literal observance of the Rule of St. Francis, to oppose the broadening influence which mitigations of that rule had introduced. The movement was extreme, as reactions are apt to be, for its zealous supporters, called *Zelanti*, believed their rule to be identical with the Gospel and hence inadmissible of

dispensation. Nevertheless it served to stimulate the rest of the community, called Observants, and regulating moderation by discipline, the Order flourished anew. The history of the Spirituals is that of three groups distinguished by time and place as: 1. the Spirituals of the Marches of Ancona, which flourished c. 1274-1317, and thereafter became identified with the heretical Fraticelli; 2. the Spirituals of Provence, c. 1280-1318; 3. the Tuscan Spirituals, c. 1309-18.

SPITHEAD, a roadstead in the English Channel between the Hampshire coast and the northeastern coast of the Isle of Wight. It is important as the eastern entrance to Southampton and the northern entry to Portsmouth Harbor, the chief British naval station.

SPITTLE INSECTS, small insects related to true bugs, whose nymphs are found in masses of white froth on grass and herbs. This froth was originally called "frog-spittle." It is produced by the insect, however, and not by frogs. See FROG, HOPPER.

SPITZBERGEN (Norwegian *Svalbard*), a group of islands in the Arctic between GREENLAND and NOVA ZEMBLA, about 400 mi. north of Norway, the five largest of which are West Spitzbergen, Northeast Land, Edge Island, Barents Island, and Prince Charles Foreland. The total area is about 25,000 sq. mi. The region has been from the first a center of exploration and in the 20th century became a source of international dispute because of its rich mineral deposits. In 1925, Norway officially took possession of the archipelago. Mining continues throughout the year, but on account of pack ice, the export season extends only from May to September. There are extensive deposits of coal of various geological ages and of different qualities, including good steam and bituminous. There are also bituminous shales, magnetic and other iron ores, copper, lead and colored marbles. The only trees are dwarf willow and birch which grow about 2 in. in height.

SPLEEN, a purplish, generally oval shaped organ lying in the extreme upper portion of the abdominal cavity. It occupies a position to the left of the stomach and immediately below the diaphragm. Under normal conditions it cannot be felt through the abdominal wall because of its size and position. In adult life the organ weighs a little less than one half a pound and measures about 5 inches in length and 3 inches in width. The organ is of a soft consistency because of its rich blood supply and type of cell structure. Externally it is covered by a thin capsule of fibrous tissue and muscle fibers. The muscle fibers, contracting at regular intervals, cause changes in volume of the organ. The fibrous tissue capsule sends strands of tissue into the splenic substance or pulp to form a framework for the organ.

The cells found in the spleen are of two general types. Scattered through its substance are small collections of lymphoid cells which compose the Malpighian bodies and closely resemble other lymphoid collections, like tonsils, adenoids and lymph glands. The cells of the second group are called splenic pulp or endothelial cells. They are capable of ameboid

motion and have the power to ingest other smaller cells and undesirable substances, and are part of an important group distributed throughout the body that also have the same properties. (Reticulo-endothelial system.) Besides these cells of the spleen proper, it also contains the cells found in the circulating blood.

The blood supply of the spleen is unique. The arterial blood passes to the venous channels by three different ways instead of the usual capillary plan found elsewhere in the body. In any of these routes the blood comes in intimate contact with the splenic pulp, which makes it easy to perform its scavenger function. Another feature of its blood supply is the large caliber of the vessels, which serve as blood reservoirs.

Many functions have been ascribed to the spleen. These have varied from important physiologic duties to associations with the emotions. In the past it was a popular belief that the spleen was the seat of ill humor and unpleasant mental reactions. Early in embryonic life the spleen is one of the blood forming organs like the bone marrow. At birth, however, it loses this function, but retains the capacity to revert to blood cell formation in time of need. The property of its pulp cells to engulf red corpuscles, bacteria and amorphous material make it an important scavenger of the body. This organ has often been called the graveyard of red blood cells because of its ability to remove worn out or undesirable erythrocytes from circulation. Besides its capacity for storing blood, it also stores iron, pigments and has been regarded as the richest storehouse of iron in the body.

The spleen enlarges in many infectious diseases and disorders of the blood-forming system, due to its increased functional activity. (See PURPURA.) Many other functions are also attributed to the spleen, some of which are yet to be definitely proven. It can be surgically removed without threatening the life of the individual, because those duties performed by the spleen can be taken over by cells having the same function in other parts of the body. H. G. P.

SPLEENWORT, the general name applied to a genus (*Asplenium*) of elegant, mostly evergreen ferns of the true fern family. There are several hundred species widely distributed in various parts of the world, many of which are more or less cultivated; about 25 species occur in North America mostly in the eastern and southern United States. Among the best known are the ebony spleenwort (*A. platyneuron*), the maidenhair spleenwort (*A. Trichomanes*) and the wall rue spleenwort (*A. Ruta-muraria*). Among the cultivated species is the bird's-nest fern (*A. nidus*), native to Asia.

SPLIT, in mining, a division of a ventilating current of air. In large mines one current of air cannot be passed to all workings and it is necessary to "split" the main current. See also VENTILATION, MINE.

SPLIT. See SPALATO.

SPLITS, in stock market parlance, the splitting of the COMMON STOCK of a corporation into a greater number of shares by allowing the holder of old

shares to exchange them according to a fixed ratio for new shares. In 1929 the Ford Motor Company exchanged 20 shares of new stock for one share of old. General Motors, General Electric, Canadian Pacific and other companies also increased the number of their shares outstanding in this manner. There is a tendency among the larger corporations to seek public favor through the creation of a large number of small shareholders. Stock is split up also for purposes of convenience in dealings.

SPODUMENE, a mineral of the PYROXENE group, found in PEGMATITE veins, sometimes forming crystals up to forty feet in length. It is ordinarily white and nearly opaque, but may be gray, green, pink or purple. Spodumene consists of lithium aluminium silicate, crystallizing in the MONOCLINIC SYSTEM.

Two transparent varieties are valuable as gem stones. KUNZITE is of a delicate pink to lilac color; hiddenite is yellow green to emerald green. The deep green varieties show pleochroism.

Huge crystals of spodumene have been found in South Dakota. It also occurs in Sweden, Ireland and Brazil. Hiddenite comes from North Carolina, and Kunzite from California and Madagascar. *See also* GEM STONES.

SPOHR, LOUIS (1784-1859), German composer and violinist, was born at Brunswick, Apr. 5, 1784. In early manhood he toured extensively as a virtuoso, and was widely recognized as one of the great violinists of the period. He also conducted frequently in Europe and England, and in 1822 was given a life-appointment as court conductor at Kassel, where he held the baton until two years before his death. It was as a composer, however, that he is chiefly remembered. Few of his works, which include 11 operas, 9 symphonies, 34 string quartets, 15 violin concertos, and 4 oratorios, notably *The Last Judgment*, are currently performed. But in craftsmanship and chromaticism he occupies a distinct place among the romantic composers of the 19th century in Germany. He died at Cassel, Oct. 22, 1859.

SPOILS SYSTEM, the practice of political parties of basing appointments and removals from office upon party service rather than individual merit. Before 1828 party organizations in most states had adopted the practice. The triumph of the Democratic forces in the national election of 1828 opened the way for the nationalization of the spoils system. President Jackson removed 919 Federal officeholders in the first 18 months of his administration, replacing them exclusively with men from the ranks of the Democratic party. William L. Marcy, prominent Democrat and friend of Jackson, coined the famous phrase, "To the victors belong the spoils." The system was adopted by both major parties. Its dangers and abuses evoked a movement for civil service reform, which has removed many classes of Federal service from party control.

SPOKAN, a group name for several small Salishan-speaking American Indian tribes living on and near the Spokane River in northeastern Washington. They

now live on the Cœur d'Alene Agency in Idaho and the Spokane Reservation in Washington.

SPOKANE, city and county seat of Spokane Co., in the eastern part of the State of Washington, on the Spokane River, 242 mi. east of Seattle. It is the commercial and financial center of the region known as the "Inland Empire," comprising eastern Washington, western Montana and Idaho. The transportation facilities include the Northern Pacific, the Great Northern, the Chicago, Milwaukee, St. Paul and Pacific, the Union Pacific and the Spokane International railroads. Spokane derives water power from Spokane River. The chief manufactures are lumber, planing mill, flour and grist mill, and foundry and machine shop products. In 1929 the value of the manufactures was about \$46,000,000; the wholesale trade proper amounted to \$52,091,186 and the retail trade, to \$77,195,597. Spokane is an important jobbing center, a supply point for the mines of Oregon, Washington and Idaho and the distributing point for the surrounding agricultural region. The city is the seat of Gonzaga University and Whitworth College. The name Spokane, derived from an Indian tribe, signifies "children of the sun." Spokane was founded in 1872 by James Glover. Pop. 1920, 104,437; 1930, 115,514.

SPOLETO, a city of central Italy in the province of Perugia, situated at the foot of the wooded Monte Luco, on a hill surmounted by an old castle rebuilt in the 14th century. It is the seat of an archbishop. The cathedral was founded by the Lombard dukes of Spoleto, who ruled the city from about 570 to the end of the 9th century. In the 12th century under Emperor Frederick I Barbarossa, it was frequently in the hands of German dukes. Spoleto has macaroni factories and in the vicinity are lignite mines and extensive olive groves. Pop. 1931, 32,595.

SPONGE, the popular name for members of a subkingdom (*Parazoa*) of many-celled animals (*Metazoa*), which is off the main line of evolutionary development. The ancestors of sponges, like the ultimate ancestors of higher animals, were protozoa, but the basic branch of the many-celled animals which is occupied by the *Parazoa* has never given rise to higher forms, while the corresponding branch occupied by the simplest *Enterozoa*, such as Hydra, has led to worms, and lobsters, fish and men. There are several thousand species of sponges, found in every sea, from the shallowest coast water to a depth of six miles. The members of one family (*Spongillidae*) have invaded fresh water, and live in lakes and streams all over the world. Marine sponges range in size from about 1/25 in. across to over 3 ft. They often form large colonies, in which it is impossible to distinguish the individuals.

Sponges vary greatly in shape; they may be globular, cup-shaped, branched like coral, or formed like elongated hornet's nests. Some, like the deep sea Celebes sponge (*Esperiopsis challengerii*) grow on stalks, and resemble a row of flowers; others are very irregular. In many sponges the shape of the individual depends

greatly on its environment. Non-calcareous species are often brilliantly colored, red, orange, yellow, green, blue or purple; while calcareous species are usually white. The two features which distinguish them from most higher forms are that, as adults, they are fixed in one place, and that they have no nerve cells.

Most sponges have a skeleton secreted by special cells, spongioblasts and scleroblasts. It may be formed wholly of a substance called spongin, closely allied in chemical composition to silk and horn, or it may be made of calcareous or silicious spicules. In some species it is composed of spongin and silicious spicules together. Bath sponges consist of the cleaned and dried skeletons of members of two genera, *Euspongia* and *Hippospongia*, abundant in the Mediterranean and about the Bahama Islands and Florida.

A sponge feeds on minute organic particles—one-celled plants and animals and organic debris. Its body is perforated by a system of canals of greater or less complexity through which water enters by tiny pores, leaving the body by one or more vents, which are the holes in bath sponges. The creature is kept moving by the whip-like flagella of collar cells, which in the simplest sponges, line the single cavity in its center. In highly organized species, with complicated canal systems, the collar cells are found in specialized chambers. From the constantly moving current of water the sponge obtains its nourishment. The collar cells pick up food, and pass the surplus to the other cells of the body. Sponges may reproduce by budding; they may form gemmules, or they may reproduce sexually. Most species are hermaphroditic. The larvae are at first free-swimming, but they soon anchor themselves to some foreign object.

In 1929 sponges amounting to a total of 529,000 lbs. with a value of \$880,000 were taken in the waters along the south Atlantic and Gulf coasts.

SPONGE FISHERY. The commercial sponge fisheries of the world are limited to the Mediterranean, the coasts of Florida and the Bahama Islands, and Torres Straits and the west coast of Australia. Only in these shallow warm waters do sponges occur in sufficient numbers to make the taking profitable.

The Mediterranean yields five varieties of sponges, the best grade being the fine Turkey cup sponge (*Spongia officinalis mollissima*). Next in value, and almost as soft and fine in texture, is the fine Turkey solid sponge (*Spongia officinalis adriatica*) which is the common bath sponge of Europe. This is cushion-shaped and is larger than the cup sponge. Third in value is the Zimocca, also called brown Turkey and hard Greek. This sponge (*Spongia zimocca*) is usually a cup-shaped flattened disc with a rough surface which makes it suitable for scrubbing. The elephant's ear (*Spongia officinalis lamella*), because of its elasticity, is used for stuffing, while its flat shape and texture make it suitable for polishing. The honeycomb sponge (*Hippospongia equina*) is the largest of the bath sponges and its size, the uniform texture and wide holes distinguish it from the Tur-

key solid sponges. It differs from the bath sponges of Florida and the Bahamas in having a continuous skin between the holes.

The wool sponge (*Hippospongia gossypina*), the ordinary bath sponge of the West Atlantic, has a surface like lambs' fleece. The velvet sponge (*Hippospongia maendriiformis*) ranks next to Turkey sponges in softness. The hard-head or honeycomb reef sponge (*Spongia agaricina*) and the hairy yellow sponge (*Spongia corlosia*) resemble the Zimocca of the Mediterranean, while the grass sponges (*Hippospongia graminea*) and (*Hippospongia cerebriformis*) are the least valuable. In 1930 the production of sponges in Florida was 529,000 lbs., valued at \$880,000.

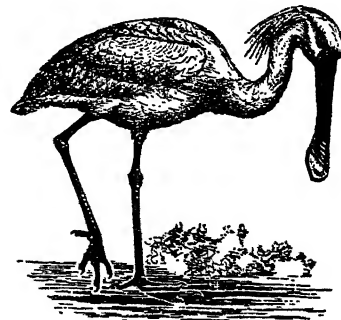
Since sponges grow in shallow water, they are obtained by dredging, with long handled rakes and forks, or by diving.

SPONSOR, a godfather or godmother, an adult who, at the baptism of an infant, repeats the confession of faith and replies to the questions asked by the minister. Thereby the sponsor assumes the responsibility for a Christian education of the child. In the course of time, however, the sponsors have become little more than witnesses of the baptism and at most send occasional presents to the godchild. In the Catholic Church, the sponsors should be present at the child's confirmation. There are also special confirmation sponsors. (See CONFIRMATION.)

SPONTANEOUS COMBUSTION. See COMBUSTION.

SPOOLING, the textile-manufacturing process by which yarn is wound on spools. Ordinary spooling, as preparatory to WARPING, is being rapidly superseded by cone winding, because the cone is better adapted than the spool to unwinding satisfactorily at high speed. The so-called automatic spooling, however, produces a yarn package of the cheese-type, which is well adapted to a special type of high-speed warping.

SPOONBILL, the common name for a small family (*Plataleidae*) of wading birds allied to the



EUROPEAN SPOONBILL

ibises but differing in their long, flattened bill, which is enlarged at the end somewhat like the bowl of a spoon. There are about 6 species frequenting marshy shores widely throughout the world. They are of

large size, with a long neck and legs, large wings and usually white plumage tinged with red. Several have ornamental crests or plumes. Gregarious in habit, they feed upon fish, frogs, crustaceans and other aquatic animals for which they wade in shallow water. They breed in large communities, nesting in trees and laying three to five whitish, reddish-spotted eggs. They fly with the neck and legs extended and



DRAWING BY GEORGE MIKSCHE SUTTON
ROSEATE SPOONBILL

utter harsh, heron-like cries. The beautiful roseate spoonbill (*Ajaja ajaja*), nearly 3 ft. long, found in tropical and subtropical America, has predominantly pink plumage. Though formerly abundant along the Gulf coast, it has been practically exterminated in the United States by plume hunters.

SPORADES, a group of islands in the Aegean Sea east of the Cyclades. Modern geographers have divided the Sporades into two groups, the southern being east of the Cyclades and the northern north of Euboea. Of these latter Scyros is one of importance.

SPORE, a microscopic, typically one-celled (but often with two or more cells), reproductive organ in plants, capable of growing directly into a new plant. The last feature distinguishes it from a gamete, which is capable of growth only after fusion with another gamete. Numerous types of spores are recognized, differentiated by their structure, origin, or future development, and described by different names. A zygote, zygospore, oospore, or egg is produced by the fusion of gametes; zoospores are motile spores; ascospores, basidiospores, conidia or conidiospores, teliospores, and other special types occur in fungi; in higher plants both small microspores and large megaspores are produced. In flowering plants the former are commonly called pollen-grains. H. A. G.

SPORE PLANTS, the name applied to those cryptogamous or flowerless plants in which reproduction is effected chiefly by means of spores instead of by seeds as in the flowering plants. The spore plants embrace the three great classes of the vegetable kingdom known as the fernlike plants (*Pteridophyta*),

the moss-like plants (*Bryophyta*) and the thallus-like plants (*Thallophyta*) including the fungi and algae. See also BRYOPHYTES; PTERIDOPHYTES; THALLOPHYTES.

SPORTING PRINTS, a branch of pictorial art that was sponsored in England and began to flourish in the late 18th century. Earlier representations of the chase had been made by Continental artists. A set of French prints relating to sport was published as early as 1617, and a work on horsemanship was executed in England, by a Fleming, in 1658. But sporting prints, as they are commonly known, date from about 1780 and continued in vogue for a century. AQUATINT was the commonest and most successful means of reproduction although woodcuts, ETCHING,



ATTEMPTING A HOLD: 16TH CENTURY WRESTLERS
From a woodcut by Lucas Cranach (1472-1553)

line-engraving and LITHOGRAPHY were also employed. The subjects were taken from hunting and angling, Newmarket, Epsom and the Derby. Famous trotting-horses and sporting dogs were shown to the life, and a cock-fight, on one occasion, had a key containing the names of the eminent persons present. The work of such famous artists as Rowlandson Thomas (1756-1827) and E. H. LANDSEER is to be found among sporting prints. The prize-ring had a distinct vogue in sporting prints and as late as 1860 the fight between Sayers and Heenan was drawn in lithography, but by this time the quality of the prints, as well as public interest, had declined.

SPOTSWOOD, ALEXANDER (or SPOTTISWOOD) (1676-1740), British soldier and American colonial governor, was born at Tangier, Africa, in 1676. He was made Governor of Virginia in 1710, and was active in improving the cultivation of to-

bacco. He also encouraged trading with the Indians, advised the erection of forts along the frontier, aided the settlement of the interior and promoted education. His term closed in 1722, but he remained in America and was made Deputy Postmaster General. He died at Annapolis, Md., June 7, 1740.

SPOTSYLVANIA, BATTLE OF, May 8-18, 1864, in the CIVIL WAR, a series of combats in the wilderness below the Rapidan River. After the BATTLE OF THE WILDERNESS Grant directed the Union army toward Richmond, hoping to circle the right wing of the Confederate line. But Gen. Lee massed his army upon the hills near Spotsylvania, Va., to intercept the Federal line of march. The fighting began with the attack of Gen. Anderson's division against the advance detachment of the Union army under Gen. Warren. Meanwhile other corps of both armies arrived, and on the 9th the battle began along the line, the Confederate entrenchments being defended by Generals Anderson, Ewell and Early. In the several assaults of the next two days the Union Generals Hancock and Upton distinguished themselves; but the Federal army missed opportunities to pursue its advantage. On the 11th, while both armies rested, Grant wrote his famous dispatch to Gen. Halleck, "I propose to fight it out on this line if it takes all summer." Generals Hancock and Burnside led desperate assaults on the 12th, which gained a wedge-like entry into the Confederate line and compelled Lee to withdraw his forces to new entrenchments. Federal casualties were about 20,000; the Confederate losses, over 12,000.

SPRAT (*Clupea sprattus*), is a small fish of the herring family (*Clupeidae*), found in the open sea along the Atlantic coast of Europe, where it swims in enormous schools. It is a popular food fish and is caught in large numbers, to be sold fresh, salted, or in cans. Rarely more than 6 in. long, it is sometimes substituted for anchovies or sardines. The spawning season opens in the early spring when the sprats are in deep water. Several fishes are called sprats in the United States, but none are closely related to the true sprat. See also ANCHOVY; SARDINE.

SPRAYING and its dry modification, dusting, is a generic term for the control of plant diseases by means of FUNGICIDES and of insect pests on plants by INSECTICIDES. Its intelligent application depends first upon what is to be controlled; second, upon when to make applications; third, upon why certain materials instead of others should be used; and fourth, upon how to make the applications. Unless these four fundamentals are established as preliminaries, the materials, time, labor and money will be more or less wasted and failure result.

In cases of doubt as to the identity of any plant disease or insect enemy, living specimens should be sent to the state or the provincial agricultural experiment station or to the national or state Department of Agriculture for identification and free advice. Since this takes time, the owner of affected plants should himself make a personal diagnosis and act according thereto.

When plants or their parts turn dark brown or black or when they wilt without any apparent surface cause, the probability is that the disease is bacterial and therefore unreachable. The only remedy in such cases is to cut off the diseased part several inches below the lowest point of apparent infection, to burn the parts removed and to sterilize the pruning tools with 0.1% solution of bichloride of mercury before making a second cut. Foliage that is more or less covered with mildew or powder, is probably attacked by a fungous disease and a fungicide, such as Bordeaux mixture or sulphide of potassium, must be used.

Leaves with notches or holes eaten in them have usually been injured by a chewing insect such as caterpillar, grasshopper or beetle, although sometimes by a disease as indicated by discoloration of the surrounding tissues. Such insects may be killed by poisons that they eat when they swallow pieces of the leaves. Standard insecticides for this purpose are arsenate of lead and Paris green used alone or in combination with certain other materials. Insects that appear usually on the undersides of the leaves and the tips of growing shoots and suck the sap must be killed by contact sprays such as tobacco, or pyrethrum extract, miscible oils and dusts. They cannot be killed by stomach poisons. Insects that resemble minute scales on the woody parts of trees, shrubs and vines are best attacked with caustics such as lime-sulphur solution while the plants are dormant.

Unless one thoroughly understands the chemistry of spraying it is advisable to avoid mixing materials indiscriminately because certain kinds neutralize others when brought in contact. Also it is advisable to follow the manufacturer's directions printed on the package of each proprietary spray because these directions are based upon that spray's active principles.

Borers, those insects that live beneath the surface of plants, cannot be controlled by spraying; they must be cut out individually or crushed to death by wires poked in their burrows. Their presence is generally indicated by the appearance of sawdust-like material pushed out of their burrows, or in the case of vine crops and other succulent plants such as squash by the wilting of leaves beyond their location. Leaf miners or tunnelers belong in this group but are too minute to combat except by the burning of affected leaves. Some species, notably the peach tree borer, are often suffocated by the gases of calcium carbide or of paradichlorobenzene buried with soil close to but not touching the bases of the tree trunks.

Various other gases are used for destroying certain insects; for instance, by hydrocyanic acid gas in fumigation tents placed over individual trees for scales on citrus fruits. This gas and carbon disulphide are also used for killing insects in stored grain and mill products and in greenhouses.

Sporadic outbreaks of such pests as army worms and locusts are generally controlled within a reasonable time by their natural enemies but are often com-

bated by poisons or fire or by oil sprayed on the ground across their line of advancement. M. G. K.

SPRAYING MACHINERY, is usually mounted for transport purposes. Sprayers for orchard work have an engine driven pump mounted on top of the tank which contains the spray material. Attached to the pump are one or two discharge lines. Row crop sprayers are essentially the same except that they are sometimes traction driven and have a fixed boom attached at the rear to hold the nozzles rigid in relation to the row. Pumps used in spray service usually work at 250-400 lb. pressure. N. R. B.

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SPRAY IRRIGATION. See IRRIGATION.

SPRECKLES, CLAUS (1828-1908), American merchant and sugar-refiner, was born at Darmstadt, Hanover, Germany, in 1828. In 1846 he emigrated to the United States, and opened a small store at San Francisco, Cal. He organized the Bay Sugar Refining Company in 1863, and by purchasing his beet sugar in Hawaii and by financing the Pacific Steamship Company, reduced his transportation costs and undersold competitors. Due to the control he exercised over the industry, he was widely known as the "sugar king." Spreckels invented new processes of sugar refining. He died at San Francisco, Dec. 26, 1908.

SPRING BEAUTY (*Claytonia virginica*), an attractive early wildflower of the purslane family very common in moist woods throughout the eastern United States and Canada. It is a small spreading perennial, rising from a deep tuberous root, with long narrow somewhat fleshy leaves and handsome white or pink flowers borne in loose terminal clusters. The Carolina spring beauty (*C. caroliniana*), with much broader leaves, occurs throughout the same range; the western spring beauty (*C. lanceolata*), with dark-veined pink flowers, is found from Utah westward.

SPRINGBUCK (*Antidorcas euchores*), the only South African gazelle. Formerly it moved across the high open plains in immense migratory herds estimated to contain sometimes hundreds of thousands. The popular name of this antelope indicates their habit, when alarmed, of galloping in a series of bounds, like so many rubber balls. Herds of springbucks still exist in Southwest Africa.

SPRINGFIELD, the capital of Illinois and the county seat of Sangamon Co., situated in the central part of the state, on the Sangamon River, about 185 mi. southwest of Chicago, and 100 mi. northeast of St. Louis, Mo. The city is served by the Chicago and Alton, the Illinois Central, the Baltimore and Ohio, the Chicago and Illinois Midland, the Chicago, Springfield and St. Louis, the Springfield Terminal, and the Wabash railways, bus and truck lines and an airport. Among the manufactures are machinery, watches, electric motors and flour, their value in 1929 being about \$23,000,000. In the same year the retail trade amounted to about \$45,310,000. Springfield ships large quantities of coal from the surrounding region and is also the center of an agricultural district

producing grain and livestock. The city was the early home of ABRAHAM LINCOLN, whose residence there is preserved by the state. He was buried in the mausoleum of the Lincoln National Monument.

Settled in 1819 by New England and Virginia pioneers, Springfield was made the county seat in 1821, was incorporated in 1832, chosen as capital in 1837, and in 1840 received a city charter. Pop. 1920, 59,183; 1930, 71,864.

SPRINGFIELD, a city in southwestern Massachusetts, the county seat of Hampden Co., situated on the Connecticut River, 28 mi. north of Hartford, Conn. Three railroads, airplanes, bus and truck lines serve the city. Springfield is an important commercial and manufacturing center. Its important products include government rifles, revolvers, automobiles, automobile accessories and tools, motorcycles and electric conductors. In 1929 the factory output was worth about \$121,000,000; the wholesale trade proper amounted to \$50,724,089, and the retail business, \$109,054,926. Springfield is the seat of the American International College, the International Young Men's Christian Association College and Bay Path Institute. The city was settled in 1636 by William Pynchon and his followers. Pynchon established himself as the local tyrant of the colony and held his authority until 1652. The city chartered in 1853. The *Springfield Republican*, one of the earliest and best-known of American newspapers, has been published here since 1824. Springfield has a government arsenal established in colonial times and an armory built in 1794. The buildings of historical and architectural interest include Old First Church, the union railroad station built in 1926, the court house and the beautiful new municipal group built in 1913, consisting of two colonaded buildings with a campanile placed between them. The Puritan, a statue by St. Gaudens, has been erected in Merrick Park. Pop. 1920, 129,614; 1930, 149,900.

SPRINGFIELD, a city in southwestern Missouri, the county seat of Greene Co., situated 213 mi. southeast of Kansas City. Bus lines and two railroads serve the city. There is an airport. Dairying and poultry-raising are the chief interests of the countryside, and the city is an important shipping center for eggs, poultry and butter. There are railroad shops here and various factories. In 1929 the manufactures were valued approximately at \$28,000,000; the retail trade amounted to \$30,617,008. Springfield is the seat of Drury College and Southwest Missouri State Teachers College. Located here is a National and a Confederate cemetery. Six mi. southeast is Sequoia State Park, which has several beautiful caves. The city was founded in 1830 and chartered in 1838. Wilson Creek Battle (1861) was fought 10 mi. from Springfield. Pop. 1920, 39,631; 1930, 57,527.

SPRINGFIELD, a city of western central Ohio, the county seat of Clark Co., situated at the confluence of Lagonda Creek and Mad River, about 45 mi. west of Columbus and 25 mi. northeast of Dayton. Transportation facilities include the Cleveland, Cin-

cinnati, Chicago & St. Louis, the Pennsylvania and the Erie railroads, bus-lines, traction lines and a municipal airport. Springfield is in a fertile farming district yielding crops of corn, wheat, oats, hay and potatoes. Four and one-half million rose plants are shipped annually. Among industrial products are agricultural implements, for which the city is widely known, trucks, electric motors, castings, machinery and magazines, one firm alone shipping over 15,000,000 magazines every year. In 1929 the value of manufactures was about \$110,000,000; the retail trade amounted to \$35,894,769. Springfield is the seat of WITTENBERG COLLEGE. In the city are the State homes of the Masonic Order, the Knights of Pythias for children and the aged, the Independent Order of Oddfellows and the Oesterlin Lutheran Home for children.

In 1799 James Demint built a cabin overlooking Lagonda Creek, on the present site of Springfield. In 1801 he planned the town. The settlement prospered despite threatened Indian trouble, which finally was averted through a council with Chief Tecumseh. Springfield was incorporated as a town in 1827 and in 1850 secured a city charter. Pop. 1920, 60,840; 1930, 68,743.

SPRINGFIELD, a city in northern Tennessee, the county seat of Robertson Co., situated in an agricultural region, 29 mi. northwest of Nashville. The Nashville, Chattanooga and St. Louis Railroad serves the city. It is a shipping center for tobacco, grain and livestock and has grist, woolen and sawmills. Pop. 1920, 3,860; 1930, 5,577.

SPRINGHILL, a town of Cumberland Co. Nova Scotia, Canada, situated on the Canadian National and Canadian Pacific railways, about 75 mi. northwest of Halifax. The town lies at the center of an important coal mining region; some agriculture is carried on in the environs, and local manufactures include bottle works. A monument erected in 1894 commemorates 125 men killed in 1891 by a mine explosion. Pop. 1921, 5,681; 1931, 6,345.

SPRINGS, outflowings of ground-water, issuing through natural channels, in volume sufficient to support a flow. Small springs are commonly of the gravity, or hillside type. Their waters are guided to the point of emergence along sloping underground strata of relatively impervious clay or rock.

Springs of the first magnitude are those having a discharge of at least 100 second-feet, 4,480 gallons a minute. These are usually either artesian, rising from great depths through vertical fissures in the rock, or occurring in limestone regions where they represent the outlet of subterranean streams. The largest spring in the United States emerging from cavernous limestone is probably Silver Spring, in Marion Co., Florida. This gives rise to a navigable river.

Fissure springs are often large, like those along the Snake River, Idaho, whose cascades have been harnessed to furnish electrical power. Their waters are frequently warm or, as in volcanic regions like Yellowstone National Park, boiling hot.

All spring-water, but especially the water of hot-springs, carries mineral matter in solution. When this is uncommon in character or amount, or has medicinal properties, the springs are called mineral springs, and invalids frequent them to bathe in, or to drink the waters. *See also* MINERAL WATERS.

SPRINGS, a term when used mechanically refers to elastic bodies which recover their shape after being distorted by extension or compression. They may be used to store power as to run watches and clocks, relieve shocks as in automobiles, measure weight as in scales and for many other mechanical purposes.

Springs are made in a variety of shapes as coiled, helical, cantilever, semielliptic and elliptic. Coiled and helical are usually of a single material either round or square in cross section, while those of the elliptic type consist of several slightly curved leaves of different lengths. These leaves are of the same width and thickness, usually fastened together at the center as in the semielliptic spring with the ends free to slide. In a helical compression spring the best results are generally obtained if its outside diameter equals eight times the diameter of the wire. Examples of helical springs are those on the wheel trucks of railroad cars, while semielliptic are illustrated in automobiles where they connect the chassis with the wheel axles, thus relieving the body of road shocks.

Materials selected depend on the purpose for which the spring is to be used. If one is to be constantly extended and compressed with varying loads, a material with different properties must be decided on than when the spring is only occasionally extended. For certain loads and conditions rubber has been used, but steel, phosphor bronze, and brass are usually chosen. For steel the Society of Automotive Engineers has prepared specifications covering a wide field.

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SPRING-TAIL, a primitive wingless insect of the order *Collembola*. These insects do not undergo metamorphosis; young resemble the adults in form. They are very small or even microscopic in size. Spring-tails are common in damp places, especially under stones and decaying vegetation. They are sometimes very abundant on the surface of snow or of standing water. Spring-tails derive their name from the peculiar springing organ at the caudal end of the body. By means of this organ, the insects can spring or leap considerable distances. When not in use, it is folded beneath the abdomen. A ventral tube is present on the under surface of the abdomen. From eversible sacs in this tube a sticky substance is produced which enables the insect to cling to smooth surfaces.

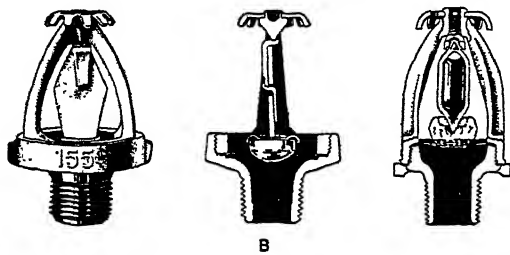


SPRING-TAIL

SPRING-TOOTH GEARS. See GEARS AND GEARING.

SPRING VALLEY, a city in Bureau Co., northern Illinois, situated on the Illinois River, about 100 mi. southwest of Chicago. River craft and three railroads afford transportation. The region has coal mines, timber lands and good farming country. The city is a shipping market, and has overall and garter factories. Spring Valley was founded in 1885 and incorporated in 1886. Pop. 1920, 6,493; 1930, 5,270.

SPRINKLERS. Automatic sprinkler systems for FIRE PROTECTION consist of gridirons of small pipe attached to the ceilings of buildings and equipped with nozzles spaced so the water spraying from each one overlaps the discharge from those adjacent. Nozzles are sealed with an alloy melting at a low temperature so that heat opens the outlets, permitting



COURTESY THE GRINNELL CO.

SPRINKLER HEADS

A, Solder type, assembled. B, side-view cross-section of solder type. C, quartz bulb sprinkler head

the escape of water and thus lowering the pressure. The drop in pressure actuates a fire alarm. Another type of sprinkler substitutes for the alloy a quartz bulb containing a special liquid of large coefficient of expansion. When heat is applied this liquid expands filling the free air space and breaking the bulb.

SPRINTING, foot racing over short distances. The sprinting events are usually considered to be the 100-yard and 220-yard dashes. In the OLYMPIC GAMES, where the metric system of measurement is used, the two sprinting events are 100 and 200 meters, making them slightly longer than the standard English and American distances. For years scientists claimed that it was impossible for a human being to run 100 yards in faster time than 10 seconds; but in 1903 Arthur Duffy of the United States disproved this by running 100 yards in $9\frac{3}{4}$ seconds. In 1929 Edward Tolan ran the 100 yards in $9\frac{1}{2}$ seconds, and in 1932 Ralph Metcalfe equalled this record. In a race lasting less than 10 seconds, obviously much depends on the start, the runner who can leave his mark with the very flash of the starting gun having a great advantage. The champion sprinter is therefore a man who can at will unleash an enormous burst of energy for a short time. In the 220-yard dash, much the same rules apply, although the start is not quite so important. The record for this stands at $20\frac{3}{4}$ seconds, being made by Metcalfe in 1932.

SPROCKET OR SPROCKET WHEELS; wheels with teeth-like projections on the rim designed to

engage openings in wheels having similar teeth, or links in a chain for transmitting power. They resemble GEARS, especially when cut for use with silent chain. See CHAINS; also POWER TRANSMISSION, MECHANICAL.

SPROUL, ROBERT GORDON (1891-), American educator, was born in San Francisco, Cal., May 22, 1891. He graduated from the University of California in 1913, and seven years later was made comptroller of the university and secretary of regents. In 1925 he became vice-president of the university, and in 1930 its president.

SPRUCE, a numerous genus (*Picea*) of the pine family, comprising many valuable timber and ornamental trees. There are nearly 40 species, all natives of north temperate and cold regions ranging northward to the arctic circle. They are handsome evergreen trees, mostly of pyramidal habit, several of which attain great size and constitute a predominant element in northern coniferous forests. The spruces are characterized by thin, scaly bark; soft, pale wood; slender, whorled branches; small, very narrow leaves, spirally arranged and jointed near the stem on a persistent woody base, and oblong, pendent cones usually borne on the upper branches. From the pines the spruces differ in their solitary instead of fascicled leaves and from the firs in their pendent instead of upright cones.

Seven species of spruce are native to North America. Of these the white spruce (*P. glauca*), which ranges from Labrador to Bering Strait and southward in the Atlantic region to Maine and Minnesota, is highly valued for lumber and wood pulp, forming the basis of the Canadian wood pulp industry. It sometimes attains a height of 150 ft. with trunks 4 ft. in diameter. The red spruce (*P. rubra*), somewhat smaller than the white spruce, predominant in the Adirondack region, is also extensively utilized for lumber and pulp wood. The black spruce (*P. mariana*), much smaller than the foregoing, grows in swamps from Newfoundland to Alaska southward to Minnesota and Virginia. This spruce is also used for pulp wood and yields spruce gum. The spruces of the Rocky Mountain region include the handsome Engelmann spruce (*P. Engelmannii*), sometimes growing 150 ft. high, and the blue spruce (*P. pungens*) of similar size with characteristic blue foliage varieties of which, as the Koster blue spruce (var. *Kosteriana*) are popular ornamentals. The Pacific coast spruces include the Sitka or tideland spruce (*P. sitchensis*), found near the coast from Kodiak Island, Alaska, to northern California, and the rare weeping spruce (*P. Breweriana*) which grows only in the coastal mountains of northern California and southern Oregon. The Sitka spruce, which occasionally grows 190 ft. high with a diameter of 20 ft. at the buttressed base, exceeds in mass all other spruces and is extensively lumbered for its valuable timber.

Of the Old World species the Norway spruce (*P. Abies*), which sometimes grows 170 ft. high with a trunk diameter of 6 ft., is the most valuable. It is

wide-spread in northern Europe and Asia, forming large forests in Scandinavia, and is extensively grown for ornament and as a timber tree. Immense quantities of spruce lumber and wood pulp are exported from northwestern Europe. Besides numerous varieties of the Norway spruce, the Old World species grown for ornament include the tigertail spruce (*P. polita*) and the Alcock spruce (*P. bicolor*), both native to Japan; the oriental spruce (*P. orientalis*), a native of western Asia; the Serbian spruce (*P. Omorika*) and the Himalayan spruce (*P. Smithiana*).

While inferior to that of the pine, spruce lumber is utilized for many purposes, that of the Sitka spruce being used extensively during the World War in the construction of airplanes. In 1930 the total cut of spruce lumber in the United States amounted to 442,428,000 bd. ft. valued at the mill at \$10,467,846.48; of this total 233,136,000 bd. ft. were cut from Sitka spruce in Washington and Oregon. A. B. J.

SPURGE, the general name for a very large genus (*Euphorbia*) of plants of the spurge family, especially the herbaceous species widespread as weeds. Several are grown for ornament among which are the flowering spurge (*E. corollata*), native to the eastern United States, the cypress spurge (*E. Cyparissias*), native to Europe and formerly much planted in cemeteries and now widely naturalized in eastern North America, and the caper spurge (*E. Lathyrus*), native to Europe and naturalized in the eastern states and in California, sometimes planted to drive away gophers and moles. See also CROWN-OF-THORNS; POINSETTIA.

SPUR GEARS. See GEARS AND GEARING.

SPURGE NETTLE (*Jatropha stimulosus*), a perennial herb of the spurge family armed with stinging bristles, called also tread-softly. It is found in dry sandy soil from Virginia to Florida and west to Louisiana. The plant grows about 2 ft. high bearing heart-shaped leaves and large white fragrant flowers.

SPURGEON, CHARLES HADDON (1834-92), English clergyman, was born at Kelvedon, Essex, England, June 19, 1834. After private instruction while an usher at a school in Newmarket in 1851 he became pastor of a Baptist Church near Cambridge. When but 19 years of age, he was called to be pastor of the New Park Street Baptist Church in London, which soon outgrew its capacity, and led his congregation to build for him the Metropolitan Tabernacle. He was a prolific writer on religious subjects, and founded The Pastors' College, schools and almshouses. His influence was widely spread through the weekly publication of his sermons, which were translated into several languages and continued to be issued for many years after his death. He possessed a powerful and pleasing voice and had a command of pure idiomatic Saxon English which made his pulpit oratory very effective. Spurgeon died at Mentone, France, Jan. 31, 1892.

SPY. See ESPIONAGE.

SPYRI, JOHANNA (1827-1901), Swiss juvenile writer, née Johanna Heusser, was born near Zürich, July 12, 1827. She lived a secluded existence, spend-

ing her whole life near Zürich, and wrote her first story when she was 43 years old. Her masterpiece, *Heidi*, has been translated into many languages and is generally recognized as a classic of childhood. Among her other works are *Mazli*, *Gritti's Children*, *Moni*, *The Goat Boy* and *Rico and Wiseli*. She died in Zürich, July 7, 1901.

SQUAB, a young pigeon. It is considered most desirable to eat when about four weeks old, for at this age the squab is plump and very tender, weighing from 12 to 16 oz. Older than this, the bird has learned to walk and fly and the flesh is lean and less delicate in texture.

SQUADRON, part of a fleet or any assembly of vessels smaller than a fleet or any detachment of vessels employed on any particular service or station under command of a senior officer. It was formerly customary to name the United States naval forces in various parts of the globe, squadrons, such as European Squadron or Asiatic Squadron.

SQUALL, the name given to any sudden strengthening of the wind, longer in duration and larger in amount than a "gust." The difference is one of quality as well as of quantity since a gust, generally lasting only a few seconds, is usually the result of some interference with air currents by objects on the earth, while a squall has its origin in meteorological changes in the atmosphere. The wind velocity in a squall may attain 100 miles per hour; consequently it may blow down trees or upset small boats.

SQUAMISH, a North American Indian tribe speaking a dialect of the Salishan linguistic stock, the survivors of which now live on the shores of Howe Sound in British Columbia.

SQUARE, a hand instrument comprising two blades or a head and a blade at right angles with each other. It is used for laying out square ends or corners. Some of the cheaper squares are simply two flat blades approximately at right angles. Others, for very accurate work, are carefully made of tempered steel and ground to extreme accuracy.

SQUARE ROOT. See Root.

SQUARING A CIRCLE, an ancient Greek problem to construct, with ruler and compasses alone, a square with area equivalent to that of a given circle. The Greeks made many attempts at a solution, and it was not until modern times that it was mathematically shown to be impossible. By the use of other instruments, such as certain curves that cannot be constructed with the ruler and compasses, the problem is easily solved. A similar situation arises with respect to the trisection of an angle. See MENSURATION; PI; CIRCLE; TRISECTION OF AN ANGLE.

SQUASH, the name given to several vines of the gourd family and also to their fleshy fruit used as a vegetable. They are usually long-running, soft-hairy annuals, closely allied to the field pumpkin. Those most commonly grown in the United States belong to three groups; 1. the autumn and winter squashes (*Cucurbita maxima*) including the Hubbard, Boston marrow and turban squashes; 2. the cushaw and

winter crookneck squashes (*C. moschata*), known also as pumpkins, including the varieties called sweet potato, Quaker pie and Japanese pie pumpkins; 3. the summer squashes or bush pumpkins (*C. Pepo* var. *Melopepo*) to which belong the summer crookneck, scallop and pattypan squashes with numerous races varying greatly in form and color.

SQUASH, a game resembling racquets, played on a walled court, with soft rubber balls and bats similar in general design to tennis racquets. Like tennis, the game is probably of French origin. In the United States, the standard squash court is 31 feet long and 18½ feet wide. There are four walls, all 15 feet high except the back wall, which is only 7 feet. A line is drawn across the front wall 19 inches from the floor, denoting the play line; the service line is drawn 6 feet from the floor. The short line, dividing the court, is drawn horizontally 14 feet from the back wall, and in this rear area the service boxes are each 5 feet, 3 inches square. The squash racquet has a round striking surface, strung with cat-gut, and a handle longer than the ordinary tennis racquet. As in **HANDBALL**, players score by the number of errors made by their opponents. The ball must strike the wall between the play line and service line. In the United States a game consists of 15 points. The winner of every rally serves the next ball. Squash has a large following in New York, Boston, Philadelphia, and in Canada.

SQUASH BUG, a true bug of the family *Coreidae*, destructive to squashes and related plants. The adults are brownish black and about an inch in length. Their conspicuous eggs are laid in clusters underneath the leaves in early summer. The young nymphs are ashy gray in color. They tend to stay together in colonies on one leaf where they suck the sap. Several generations may be produced annually. They winter in the adult stage. Adults may be trapped beneath chips. "Trap crops" may be planted and sprayed with kerosene when infested. All infested vines should be destroyed immediately after harvest.

SQUATTER SOVEREIGNTY, the theory, formulated by Lewis Cass in 1847 and adopted by Stephen A. Douglas (see **POPULAR SOVEREIGNTY**), that the squatters, or occupants of a district at the time it is given territorial status, should prescribe and regulate their local institutions. Squatter sovereignty is in contradistinction of the theory that Congress possesses unlimited power of legislation over a territory.

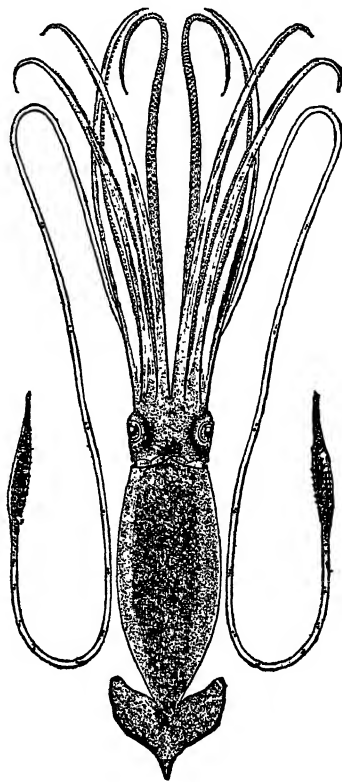
SQUAWFISH, a genus (*Ptychocheilus*) of large fishes of the *CARP* family common in rivers in the Pacific coast region. They are somewhat pikelike in appearance with long, slender bodies and large toothless mouths, and attain a length of 5 ft. or more. The genus includes the Oregon squawfish (*P. oregonensis*), valued both for food and game, found in rivers of the northwest coast, ascending the Columbia and its tributaries to Montana and Idaho; the Sacramento squawfish (*P. grandis*) of California and Oregon, and the Colorado river squawfish (*P. lucius*), the largest member of the family, attaining a weight of 80 lbs., of the Colorado basin.

SQUAXON, a sub-group of the Nisqualli, a Salishan-speaking tribe of the North American Indians. The Squaxon live between Hoods Canal and Case Inlet, Wash., under the Puyallup superintendency.

SQUEEZE. The material under coal is usually clay, which softens with time and frequently exudes from under the heavily laden **PILLARS** of a mine and flows into the gangway. Such a movement when gradual is a squeeze. See also **BURSTS**; **MINING**, **COAL**.

SQUETEAGUE, the North American Indian name for the common **WEAKFISH** and its close allies, important food fishes of the Atlantic and Gulf coasts of the United States.

SQUID, the popular name for members of a sub-order (*Teuthoidea*) of ten-armed cephalopods. There are many species found in every sea. Some of the



GIANT SQUID

(*Architeuthis princeps*). The largest known cephalopod, with a body sometimes 20 ft. long and arms 35 ft. long

most interesting are the flying squids (*Ommastrephes*) which sometimes leap through the air, the fire squids (*Nematolampas*, *Thaumatomolampas*, *Abralia*) that have phosphorescent organs, and the giant squids (*Architeuthis*), the largest of all invertebrates, which are sometimes 50 ft. long. Many species, as the common squid (*Loligo peali*) of the Atlantic coast from Maine to South Carolina, are less than a foot long.

Squids are fantastic looking animals, often gorgeously colored red, pink, orange, yellow, blue or

purple. Their bodies are generally long and conical, with two more or less triangular fins at the tail ends. Ten tentacles surround the mouth. Two of these, longer than the rest, have suckers congregated at the tips, and are used for seizing prey. The other tentacles, which have suckers arranged in rows, are ordinarily used in feeding. Two well-developed, staring eyes are found back of the tentacles. The shell, so conspicuous in most mollusks, is reduced to an internal pencil, which serves as an axis in swimming.



SQUID (*Stenoteuthis pteropus*)

Squids are active, carnivorous animals, preying on crustaceans and fishes. Some of them are found living at the surface of the sea, while others live at great depths. Usually they swim quickly by means of their fins, but if even greater speed is necessary they propel themselves backward by forcing jets of water from their mantle cavities through their funnels. Occasionally they crawl on the bottom, using their tentacles for feet. To defend themselves from their enemies they can disappear behind a cloud of "ink" which they expel from sacs, after which they may change color and become almost invisible.

A. I. W.

SQUILL, in medicine, the bulb of the sea onion (*Urginea Scilla*), a smooth perennial of the lily family native to seacoasts in Europe and Africa and sometimes cultivated. A syrup prepared from sliced root is used in medicine as an expectorant and diuretic. The name squill is applied also to a numerous genus (*Scilla*) of bulbous plants of the lily family containing 80 species, natives of the Old World, many of which are grown for ornament, especially those which blossom in early spring. They are mostly low plants with very narrow root leaves and a leafless stem bearing blue, purple or white flowers. Among the best known are the star-hyacinth (*S. amœna*), the English bluebell (*S. nonscripta*) and the Spanish bluebell (*S. hispanica*).



SQUILL (*Scilla sibirica*)

SQUINCH, a method of covering over the corners of a square or polygonal room so as to allow the building of a circular dome or a polygonal form with the number of sides twice that of the original struc-

ture. The squinch usually consists of a diagonal arch, with a small conical vault between it and the room corner. Sometimes, however, a succession of diagonal arches of increasing size are found. The form in which the corner is filled with a segment of a sphere is known as a PENDENTIVE.

SQUIRREL, a rodent of the almost cosmopolitan family *Sciuridae*, which comprises a large number of species exhibiting much variety in size, appearance and habits. Typical squirrels are alert, familiar, inquisitive, brightly colored species, whose life is spent in trees and which possess long, plumelike tails. They



RED SQUIRREL

sleep and breed in hollows in tree-trunks, usually live on nuts and other forest products, and in cold climates store food for winter use. Related to these is a host of small terrestrial species, making subterranean homes in which some hibernate, others store food; these are the gayly dressed chipmunks and striped gophers.

Ground-squirrels are a group of larger, plains-dwelling, burrowing, grass-eating rodents with uniformly yellowish coats and short tails. Still larger are the marmots, such as woodchucks. Finally, must be included the flying-squirrels, which nest in holes in trees, are nocturnal in habit, and make long gliding leaps from trunk to trunk, sustained by expansive loose skin along the flanks. Some of the ground-dwelling squirrels become serious pests in agriculture.

E. I.

SQUIRREL CORN (*Dicentra canadensis*), a low smooth perennial herb of the fumitory family called also turkey corn. It is found in rich woods from Nova Scotia to Minnesota south to Virginia and Missouri. From the rootstock, which produces many small yellow tubers somewhat resembling peas, rise much-divided basal leaves and a slender flower-stalk

bearing a cluster of nodding, fragrant, greenish-white flowers tinged with purple.

SQUIRRELTAIL GRASS (*Hordeum jubatum*), a long perennial so named because of its soft, brush-like, long-awned flowering spikes. It is a native of



SQUIRRELTAIL GRASS
Plant in flower and joint of spike

north temperate regions widespread in North America, especially in the western states where it is often a troublesome weed in alfalfa fields. Various closely allied species of *Hordeum* are also called squirreltail grass.

SQUIRTING CUCUMBER (*Ecballium Elaterium*), a trailing hairy perennial of the gourd family, native to Mediterranean countries and cultivated for its peculiar fruits. It bears broad heart-shaped leaves, yellow, five-parted flowers and greenish, rough-hairy oblong fruits, about 2 in. in length. When mature the fruit drops from its stalk and forcibly ejects the brownish seeds, mixed with a watery fluid, through the aperture made by the removal of the stalk. The powerful purgative drug known as elaterium is prepared from the juicy pulp surrounding the seeds.

SRINAGAR, capital of the state of Kashmir, northern India, situated on the banks of the Jhelum, 5,250 ft. above sea level, in the midst of some of the most beautiful scenery in the world. Like Venice, Srinagar is a city wherein the streets consist of numerous canals, or branches of the river. These traverse the town and connect it with the neighboring Lake Dal. The Jhelum is spanned by several picturesque wooden bridges. Srinagar is renowned for its wood-carving and shawl-weaving; carpets are also manufactured. Pop. 1921, 141,736; 1931, 173,649.

STABAT MATER, a medieval Latin hymn used in the Catholic Church, describing the Virgin Mary's sorrow at the foot of the Cross. The hymn, which receives its name from the opening words, is attributed to Jacopone dei Benedetti, a Franciscan monk of the 13th century. Of its many musical settings, the most notable are those by Palestrina, Pergolesi, Haydn, Verdi, Rossini and Dvorak.

STABILITY of a vessel is extremely important, for she must be safe from capsizing. For passenger vessels, particularly liners and also warships, calculations are made of the stability under a variety of conditions. For instance, inboard profile and deck plans are drawn, and various compartments are assumed as flooded. Suppose a compartment as port forward cargo hold is flooded with water. What would be her angle of inclination or list and her trim? Such information can be arrived at by making various calculations and plotting curves of stability.

Besides assuming a vessel to be damaged and compartments flooded, it is necessary to consider the effect on her stability by the consumption of coal, oil and consumable stores. For the effect of such consumption is to raise the center of gravity of the vessel, which may be raised to such an extent that she becomes unstable. Take for example, a fast Atlantic liner consuming 500 tons of oil a day plus many tons of food; on a voyage of six or seven days, her draft, position of center of gravity and consequently her stability has changed, when she arrives at her destination. This change must be known and its effect on the stability must have been calculated by the naval architect before the vessel is built.

The calculation for the metacenter (*see* NAVAL ARCHITECTURE) is sufficient for small craft, but for large, complete stability calculations must be made, and curves drawn so a captain can tell the condition of his ship under various loading conditions. Furthermore the center of gravity of the completed ship, should be obtained by the inclining test, in fact this test is required by the U.S. Steamboat Inspection Service, or all U.S. vessels of 500 gross tons or over propelled by machinery, and every passenger vessel intended to carry 50 or more passengers.

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STABILITY TESTS, on asphaltic mixtures, are of two types: *Shear Test* samples are molded under a pressure of 5000 pounds per square inch and at a temperature of approximately 350° F. They are cylindrical, and of a size depending on the maximum size of the aggregate. For sheet asphalt, or small stone modification of such material, the cylinder is two inches in diameter and 1½ inches long; for asphaltic concrete it is four inches diameter and 2½ or 3 inches long. The pressure is applied only for a moment and the cylinders are removed from the molds at once. After cooling overnight, they are tested at a temperature of 140° F. in a specially designed shearing machine. The load is applied at

the rate of two pounds per square inch per second for the smaller cylinders and the rate is doubled for the larger cylinders. The load producing failure is the shear value.

Hubbard-Field Test is applicable only to sheet asphalt or other fine aggregate mixtures. The size of the test cylinder is two inches diameter and one inch long. Cylinders may be made from mixtures prepared in the laboratory, from samples taken on construction, or they may be cut from existing pavements. In the first two cases, the materials are heated to 350° F. and molded under a pressure of 3000 pounds per square inch.

Cylinders are tested at a temperature of 140° F. The maximum load in pounds necessary to force the asphaltic mixture through an orifice slightly smaller than the cylinder is taken as the stability value.

E. E. B.

STABILIZATION. Cataclysmic or long continued changes in the general price level, not only transfer and alter real incomes, but boom business when prices rise and depress it when prices fall. Various plans for stabilizing the buying power of MONEY have been proposed in order to ameliorate or eliminate these and other evils of fluctuation in the general price level.

BIMETALLISM was the first stabilization plan ever tried. Under this plan, gold and silver were coined freely at a ratio fixed by law. When one metal fell in value, it would be coined, while the other metal would be withheld from circulation until the mint parity was restored. This process tends somewhat to mitigate the fluctuations in the value or purchasing power of gold and silver so long as the two metals do not vary too widely. During the latter half of the 19th century, the values of gold and silver diverged so greatly that bimetalism was abandoned.

A tabular standard of value to correct or to supersede the metal standards was definitely advocated by W. STANLEY JEVONS in 1875. Jevons refers to the earlier proposals, similar in kind, made by Lowe, Scrope and Porter, and declared the proposal to be theoretically sound and workable.

However, the practical difficulties proved to be insuperable, so, as a means of securing a composite tabular standard without discarding the GOLD STANDARD, the proposal was made to vary the weight of gold in the standard money unit in accordance with changes in an INDEX NUMBER of prices. This plan, now called the compensated dollar plan, was first definitely suggested by Professor Simon Newcomb in 1879, although John Rooke in 1824 had outlined something similar; it was expounded by Irving Fisher in *The Purchasing Power of Money* (1911) and in greater detail in *Stabilizing the Dollar* (1920).

Under this plan, all gold coins would be replaced by gold certificates entitling the holder not to a fixed amount of gold, but to an amount as should be officially declared from time to time to have a fixed value as reckoned by the index number of prices.

If, for instance, the commodity price index should

rise to 102, that is 2% above the par agreed upon, that would require that the gold content of the dollar must be increased by 2%. If the index should decline to 97, it would mean that the gold content of the dollar must be reduced by 3%. In each case the increase or decrease would be by fixed rule, namely, in proportion to the deviation of the index number from par. There would be no discretion to be exercised. The action would be like that of a compensated pendulum. Any expansion or contraction would be quickly offset.

What it amounts to is that the price of gold at the United States Mint, instead of remaining immutably and artificially fixed as it has been since 1837 at the figure \$20.67 an ounce, would vary from time to time just as the price of silver or any other commodity varies, according to market condition.

Free coinage of gold would still exist. That is, the Treasury Department would be ready to buy or sell gold bullion at all times at the price indicated by the official index number.

The gold reserve behind the certificates should, of course, be kept constant at 100% by issuing or cancelling gold certificates as required. A small brassage charge of, say, one % would be imposed to prevent undesirable speculation in gold. Professor R. A. Lehfeldt of South Africa proposed that the governments of the leading gold producing nations should stabilize the value of gold money by controlling the production of gold. If the price level should rise, a tax would be imposed upon gold production until its buying power was increased and the price level brought back to normal. In case of falling prices, gold production would be stimulated by bounties until the increased supply of gold should bring the value down to normal.

A paper money standard has frequently been advocated, not always to stabilize, but often rather to destabilize money. Recently, however, Professor J. Maynard Keynes has advocated a managed currency as the best way of stabilizing the value of money and hence of prices and business; he would regulate the quantity of paper pound or dollars in circulation by a general price index.

In recent years, particularly since 1918, stabilization of money and price levels through control of bank credits (*see CREDIT and BANKING*) by CENTRAL BANKS has been strongly emphasized and, to some extent, actually practiced. This plan seems more likely to be given a fair trial than any of the others, because, up to a certain point dependent chiefly on the gold reserve, it requires no discarding, or even modification of, the gold standard.

Theoretically, the supply of currency can be regulated by the central banks to suit the needs of business. If prices rise, the banks can bring them down by raising the discount rate and selling securities, thus obliging member banks to contract their loans to customers and so to reduce the quantity of notes and checks in circulation. Conversely, the banks can stop falling prices by lowering the Discount rate and buy-

ing securities, thus putting more purchasing power into circulation.

The FEDERAL RESERVE SYSTEM has attempted, although rather timidly and tardily, to stabilize business and prices in these ways.

In any ideal plan for stabilizing the purchasing power of money which will work at all times, whatever the state of the gold reserves, requires something more basic than merely control, it requires gold control also. But credit control alone might succeed for many years before the gold reserve should, say, become too low to permit further expansion of credit. *See also* QUANTITY THEORY OF MONEY; INFLATION AND DEFLATION. I. F.

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STABLE-FLY, an insect of world-wide distribution (*Stomoxys calcitrans*) resembling its relative the house fly, a member of the family *Muscidae*. Adults of both sexes suck blood. As they are most troublesome before rains they are often called storm flies. The larvæ feed on decaying matter especially fresh horse and human excrement. Recently the adults have been suspected of carrying infection of infantile paralysis.

STACCATO, an Italian term used in musical EXPRESSION to signify that the notes are to be detached or separated. The superlative form is *staccatissimo*. In violin music the term *spiccato* indicates a staccato delivery produced by a bounding bow.

STACK or **FUNNEL** on a steamer corresponds to a chimney on a power station ashore. The exhaust gases from the boilers pass through uptakes connected to the stack, which consists of two parts, an outer and inner separated by an air space of several inches. Stacks may be given a rake or may be perpendicular to the water line, and in cross section may be circular, elliptical or stream line. The outer stack is usually painted with the colors of the company the vessel is owned by. For instance, ships of the Cunard Line have their stacks painted black at the top and red at the bottom, the Dollar Line vessels have a dollar mark (\$) on the side, while another company, the Munson Line have black, white and blue bands.

STACKERS, implements for piling large quantities of a grass crop in one place. Hay stackers are commonly home made. The types that are used with a hay fork or sling are single, double and triple-pole, cable and derrick, the latter having either an adjustable or a rigid boom. The slide or incline, used with sweep rakes, employs a pusher or ram for conveying the hay.

Overshot and swinging stackers are manufactured for use with sweep rakes. There is also a combination sweep rake and stacker which elevates the hay as it approaches the stack.

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STADIA. *See* TACHEOMETRY.

STADIUM, the Latin form of *stadion*, the name given to the Greek course for foot racing; in modern times, a large permanent structure, of general amphitheatre type, for sports and games. The first stadion, that of Olympia, built in 330 B.C., was oblong in form, with seats raised on earthen mounds, and a simple bank of earth set in the center to mark the laps of the race; stone and marble seats were not added until almost 200 years later. The Greek stadion had places for 12,000-50,000 spectators. The general form of the stadion was adopted by the Romans in the CIRCUS.

Stadium and amphitheatre are practically synonymous, either term being used of a built-up structure with tiers of seats about a central arena, although the word stadium is commonly applied to the great athletic fields of colleges and municipalities. The first modern stadium was a restoration of the stadion of Athens, in which the first revival of the Olympic Games, 1896, was held. For the games of 1908 London erected a stadium with seats for more than 50,000 spectators, and similar stadia were built for the Olympic Games at Stockholm, Amsterdam and Paris. Municipal stadia constructed in recent years are those at Chicago and Philadelphia, capacity of each, 125,000; Los Angeles, about 75,000 but rebuilt to seat 105,000 for the Olympic Games of 1932; the White City Stadium at Wembley, London; and the Pershing Stadium in the Bois de Vincennes, Paris. Most American colleges and universities have some form of stadium; the largest are those of the University of California (90,000), and Stanford University (88,000), and the Yale Bowl (80,000).

STAËL, MADAME DE (1766-1817), French writer, née Anne Louise Germaine Necker, was born in Paris, April 22, 1766, the daughter of Necker, the financier. At an early age the future Madame de Staël gave evidence of an unusually awakened mind, her precocity and high spirits being notorious. In 1786 she married the Baron de Staël-Holstein, the Swedish Minister in Paris, although there was not the slightest pretence of affection on either side. Three children were born of this marriage. Passionately enamored of publicity, Madame de Staël soon crossed swords with Napoleon, and Madame de Staël was exiled. She settled at Coppet in Switzerland and consoled herself with authorship. *Corinne*, *Delphine* and *De l'Allemagne* are her best known books. Left a widow, she married in 1811 a young man named de Rocca, who was 23 years younger than herself, and to whom she bore a son. Her contemporaries grossly exaggerated her literary powers, and although accorded first-rank eminence in her own day, she is but little read now. Madame de Staël died in Paris, July 14, 1817.

STAFF, in military usage, a group of officers assigned to a commander to assist him in the execution of his duties of command, administration and supply, each staff officer having specific duties. Acting in an advisory capacity to the Secretary of War, is a chief-of-staff with five assistants at the head of a War Department general staff. Each assistant is head of a

division, there being personnel, intelligence, operations and training, supply and war plans divisions. There also exists an administrative staff corps comprising the adjutant general's department, inspector general's department, quartermaster corps, finance department, medical department, ordnance department and chemical warfare service. Each corps area, department and tactical and administrative unit down to the battery and company have a staff with four divisions corresponding to the first four divisions of the general staff.

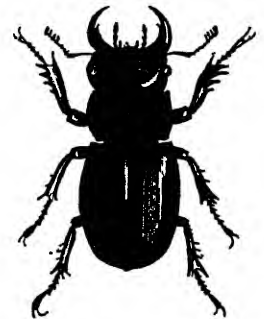
STAFF (or Stave), in music, a group of five parallel and horizontal lines, upon which and between which notes are written. At the beginning of one of the lines a CLEF is placed to determine the pitch of that particular line, and by reference to it the pitch of all other lines and spaces. The evolution of the staff is important in the history of musical NOTATION. It first began to take shape in the Middle Ages, notably under GUIDO D'AREZZO and HUCBALD DE ST. AMANDO in the 10th and 11th centuries. Between 1200 and 1600 the number of lines was highly variable, occasionally running to as many as twelve, but thereafter five lines were accepted as the standard number in secular music. In ecclesiastical music four lines have been used for many centuries and still are the accepted number in liturgical music.

STAFFORD, the county town and a railway junction of Staffordshire, England, on the Sow, about 133 mi. northwest of London. Mentioned in the Anglo-Saxon Chronicle, William the Conqueror later built a castle at Stafford which was destroyed in the 17th century wars. Many sturdy, half-timbered houses survive in the largely modernized town, among them the Swan Hotel which once accommodated DICKENS. Of the two parish churches, St. Mary's has a memorial to IZAAK WALTON who was baptized at its font. To-day as in the past, the chief industry is the manufacture of boots and shoes which prompted Sheridan's famous toast: "May the trade of Stafford be trod underfoot by all the world." Pop. 1921, 28,635; 1931, 29,485.

STAFFORDSHIRE WARE. Although Staffordshire is the chief seat of the English pottery industry and has been the scene of most of its development, the term "Staffordshire ware" is principally applied, in everyday usage, to the little earthenware figures which were made there in great profusion in the 18th century. At first they represented scenes of rural life; the shepherd and shepherdess, the landlord and his lady, were popular groups. Hunting figures and scenes were also favorites, and a little later famous sculpture was copied. Toby jugs were included, animals were fashioned as drinking cups, odd pepper and salt shakers and mustard pots were also made. Grotesques of many kinds were popular, as were more sentimental figures. Cruder and less expensive than the figures of Bow, Chelsea or Derby, the Staffordshire figures were made in very great variety, and remain as collectors' pieces of considerable life and charm. The term "Staffordshire ware" is also used

of the early peasant ware which was known in this district from the Middle Ages onward. This quite simple earthenware attained some celebrity in the Staffordshire butter pots of the 17th century, and the equally well-known Staffordshire "tyg," a three- or four-handled cup made at the same period. The manufacture of Toft dishes of "fire-brick" clay with colored slip decoration was inaugurated about 1670. About 1690 the famous Elers brothers introduced the hard salt-glazed white stoneware of Staffordshire; they also made a red unglazed stoneware. The "scratched blue" salt glaze belongs to the early part of the 18th century.

STAG BEETLE, a coleopterous insect of the *Lucanidae*, a family containing about 750 species. The stag beetle is of large size, with a hard, smooth body; the mandibles of the male are long and branched, resembling the antlers of a stag. The development of the head and mandibles varies greatly in different species. *Lucanus cervus* is the common stag beetle of Europe. *Lucanus elaphus* is the giant stag beetle of the United States.



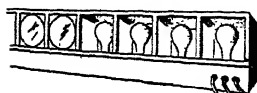
STAG BEETLE
Lucanus dama

STAGE LIGHTING.

The history of stage lighting until the present era is concerned chiefly with the development of light sources. It is only within the last half century, beginning with the use of the incandescent lamp, that lighting has become an important entity in dramatic production. Artists, producers and engineers since then have contributed to the phenomenal development of the art of lighting so that it is now possible to evaluate its various functions and to estimate its relative place in the theater arts.

The flaming torch was probably the earliest artificial light source. The Greek, Roman, Byzantine and Romanesque periods developed little more than the stone oil lamp in addition to the torch so that dramatic productions were staged during the hours of natural light or held in the form of torchlighted parades or pageants. Crude though these sources were, the use of thousands of flickering sources showed an early appreciation of the dramatic effects of artificial lighting. With the Gothic period and early church drama came the candle, which provided the basis of visibility illumination when the theater was taken indoors during the Renaissance. Elaborate chandeliers which could be raised and lowered to effect changes of intensity, flat bottles containing colored fluids to color the light, and extensive gold decorations were used to control the light given by the candle. In the latter part of the 18th century the invention of the Argand lamp chimney replaced the flickering candle with the steady-burning oil lamp,

using a wick which could be regulated to control intensity. Sheridan put rows of lamps behind the profile wings and borders of the stage settings in the Drury Lane Theatre in London in 1794. Illuminating gas, produced by distilling soft coal, was



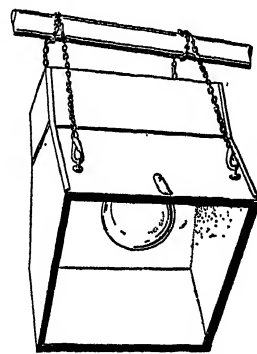
EQUIPMENT, INC.
COMPARTMENT TYPE FOOT-
LIGHTS

not used to any extent until after the beginning of the 19th century. It had many advantages over the oil lamp but it chiefly allowed the control of intensity from a central point. The lime light, a very intense white light produced by projecting an oxyhydrogen flame on a stick of lime, and the electric arc, likewise a bright source, were used extensively after the middle of the last century, and in some cases are still used for special effects. They provided the concentrated source which is necessary for lens instruments and special reflectors to give intense localized lighting. The lime light with its clumsy tank equipment has practically disappeared and the arc has only recently been replaced to a great extent by the high-powered incandescent lamp. Gaseous tubes, such as the Neon light, have not been widely used, but the recent development of a low voltage type and a control for the high voltage form indicate that their use may be more prevalent before many years. It was the invention of the incandescent lamp and recent improvements which gave the impetus to the

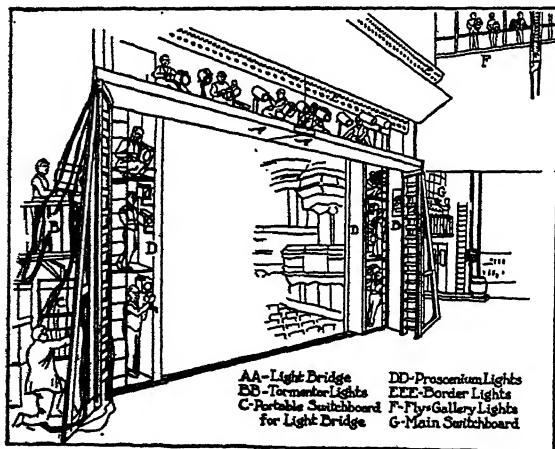
used to heighten emotion; Mario Fortuni, an Italian, for his use of the sky dome; many German producers, artists and technicians—Reinhardt, Jessner, Pirchan, Linnebach among others—for an extensive development of equipment and use of lighting. In America Steele MacKaye, David Belasco, the Theatre Guild and experimental groups have done research and experimentation. Among American scene designers, Simonson, Geddes, Jones, Sovey, Thompson, Mielziner and Oenslager have used light definitely as an element of design. Other influences, such as Thomas Wilfred and his light organ, playwrights of the experimental group, amateur and university theaters, musical and presentation producers, equipment companies, illuminating and electrical engineers and architects, are also important for recent technical developments and for more arbitrary uses of light which demonstrate beauties and dramatic values not ordinarily found in the legitimate theater.

Not until the present era have the functions of lighting in relation to the stage begun to be apparent. The obvious use of light when the theater was taken indoors was to provide visibility. Soon attempts were made to simulate the changes in time of day: to indicate the approaching of night by snuffing the candles or raising and lowering the fixtures, and transparent color media were introduced to increase the suggestions of time and place. When Edison perfected the incandescent lamp its possibilities attracted new artists, painters, architects and sculptors to the theater, and with them they brought taste and a demand for better composition in design. The development of new lighting instruments and control of effects, in harmony with the actor, gave plastic quality to the setting. It soon became apparent that, in addition to the above functions, lighting provided a certain emotional or "mood" quality which could enhance the dramatic value of the play. Thus, stage lighting might be defined as a use of artificial illumination to give a dramatic effect of visibility, time and place, composition and mood.

Designers, architects and engineers have become aware of the need for a more flexible use of light. There has been evolved, through the development of the remotely controlled dimmer, a more concentrated type of control board, approaching that of an organ console, which permits the lighting artist to express himself as freely as the organist. The motion picture industry, with the advent of sound pictures, caused the development of high-powered light sources, so that to-day there are 5,000 and 10,000 watt lamps in addition to numerous and flexible smaller sizes.



COURTESY CENTURY LIGHTING EQUIP-
MENT, INC.
THEATRICAL FLOODLIGHT



FROM LOUIS HARTMANN, THEATRE LIGHTING, D. APPLETON & CO.

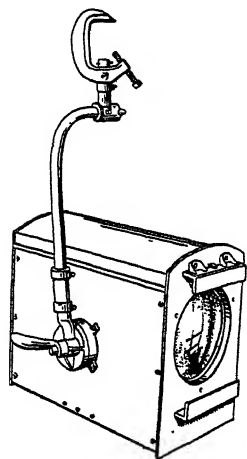
MAJOR LIGHTING SCHEME

One such as this was used in David Belasco's production of "The Return of Peter Grimm"

art of stage lighting, because it made economical great quantities of light which were subject to easy control.

Among those names with which the art of lighting is intimately connected are HENRY IRVING and GORDON CRAIG, both Englishmen; Irving because of his untiring attempts to use light to enhance the realism of the stage picture, and Craig because of his hypothesis that light is essentially a dramatic medium. Also important are Adolphe Appia, a Swiss, for his thesis that light should be treated plastically and

Because of the increased use of light in many fields, the theater now finds available more scientifically constructed instruments. The lens unit, commonly called a spotlight, with its concentrated beam



COURTESY CENTURY LIGHTING
EQUIPMENT, INC.

HANGING SPOTLIGHT, 1000-
WATT SIZE

and long throw, provides a high intensity directional light which may be used to illuminate special areas, and offers a flexibility of control over distribution that is provided by no other instrument. These are generally used to "high light" the acting area or to pick out individual characters. The projector, similar to a searchlight and much more efficient than the lens unit, serves practically the same purpose, although it offers slightly less control. The floodlight, a high-powered single source, open-faced instrument with a reflector behind it, is derived from the old bunch light, a tin pan with a cluster of small lamps, and is valuable for lighting a large area at short range. A striplight consists of a row of similar light sources, and is generally wired for three or four colors. It is used for footlights, border and background lights to give a general, shadowless distribution in a variety of colors. A number of lighting instruments used to create patterns of light, or to serve as decorative or motivating sources, fall into a group of special instruments. The projection machine, equipped with either stationary or moving slides which project static or changing patterns on the background, is operated on the principle of the slide machine or motion picture projector. Wall brackets, fireplaces, central ceiling fixtures, etc., are considered only as motivating or decorative fixtures in the stage set. Most of the light which they would normally give must be supplied by other instruments from concealed positions.

The technical nature of the means of creating good lighting has tended more than almost anything else to keep the art of lighting in a more primitive state than the other arts of the theater. However, the development of illuminating engineering, dealing with the physical, electrical, technical and physiological phases of light, provides a scientific approach to the problem, and the lighting expert, with a knowledge of design and of the audience's visual reaction

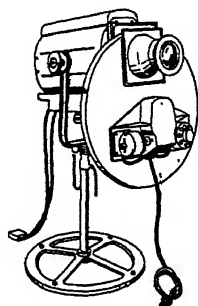
to dramatic effects, now has an opportunity to make the use of light a coordinate expression with the other arts of the theater. See also STAGE MACHINERY; STAGE SCENERY.

S. R. MCC.

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STAGE MACHINERY. The stage of Greco-Roman times, while suggesting scenery by conventional means, used forms that clearly foreshadowed modern devices. It seems to have indicated scene changes by turning painted faces of tall triangular prisms, *periaktoi*, one at each side of the stage; to have revealed inner chambers by swinging them out on the *ekkyklema*, which was probably either a turntable or a wheeled platform; to have used the *scena ductilis*, a system of interchangeable panels or light screens, ancestors of modern flats, between decorative columns in an otherwise fixed architectural background; together with trapdoors, and counterweights for levitating heavy pieces. There were also means of flooding the stage for aquatic spectacles.

In medieval times the developing miracle and morality plays (see MYSTERY PLAYS; MORALITIES) used multiple settings—that is, all the localities represented at one time on the same stage, with the action moving from one to another. But with the Renaissance, effort was made to recreate the ancient theater as described by Vitruvius and Pollux; and in many an elaborate Italian MASQUE, effects were operated chiefly by counterpoises, which required an ample proscenium arch to hide the overhead and side machinery. The rest of Europe borrowed the innovations promptly. Italian engineers, notably Jacques Torelli and the two Vigarani, father and son, were brought to Paris as master artificers of the golden age of *MOLIÈRE*, the younger Vigarani becoming builder of the famous Théâtre des Machines. The celebrated architect, INIGO JONES (1575-1652), greatly influenced by Italian studies, brought the Renaissance methods to English masques, for which he is said also to have devised the long popular scheme of changing scenes by sliding wing pieces, or "shutters," in and out in grooves at the sides, the background being filled in with a succession of painted drops, or "cloths," and the top with sky "borders." These methods were reintroduced to England after the Restoration by the actor, Thomas Betterton, brought from France at the behest of Charles II. For some years thereafter, the fundamental changes were in the matter of lighting, running all the way from candlelight to oil to gas, the wick oil lamp used in Italy before 1663 and gas coming to the theaters about 1803. General STAGE LIGHTING by electricity started in 1882 when the Savoy Theatre in London was so equipped. The groove system, for interior settings, was rendered obsolete before the middle of the 19th century by the sealed or "box" setting, with continuous sidewalls and real doors and windows, introduced into England



EFFECT MACHINE OR
SCIOPTICON

in 1841 with the production of *London Assurance*. For supporting wings and other isolated pieces still required in exterior settings, the "chariot and pole" system was brought from France into England about 1860 by the actor, Charles Fechter. The unit consisted of a small car traveling below the stage level, surmounted by a rigid mast with crossbars and extending vertically upward through a slit in the stage floor. Before 1880 a revolving stage was used in Paris for the production of *La Crime de Faverne*, having been brought from Japan, where it had originated perhaps a century before; and at about the same time, in New York, STEELE MACKAYE presented his elevator stage, with one setting ranged above another and raised or lowered into place. About 1880 came the so-called Austrian Stage Reform, an organized effort by a commercial syndicate of architects, artists and engineers, inspired by the awful fire that destroyed the Ring Theatre of Vienna. They sought to build a fireproof stage, and, while they were at it, along more scientific lines. They offered, principally, a revolving stage with a floor in sections moved hydraulically up and down; a permanent cyclorama, or "horizon," for sky backgrounds, apparently devised and first used by Engineer Lehmann at the Court Theatre, Vienna, in 1873, and a centralized system of control. The plan, with modifications, spread rapidly throughout the world, hydraulic stages being installed in Paris, London, New York and Chicago. In subsequent stages, mainly those of Karl Lautenschläger, at Munich, and Edwin O. Sachs, in London, the sectional floor was retained but operated electrically. Electric motors were also used to raise and lower drops. Other notable equipments of the late 19th and early 20th centuries were the sliding stage, or "rolling way," attributed to Otto Brahm and Fritz Brandt, of Berlin, a huge, gliding platform that held two whole settings, and carried one off as the other came on; wagon stages, a series of small platforms on wheels, supporting scenery on both sides and simply lined up to form a setting, introduced to America in 1914 by H. GRANVILLE-BARKER; and the swinging stage, devised by Joseph Wickes, of New York, at about the same time, large, low, pivoted platforms placed in the wings and turned alternately in on the acting zone, save when a setting was dropped from above. For water effects, the most remarkable modern equipment was that of the New York Hippodrome, where a stage fitted with air-bells on standards might be lowered into a tank, permitting players to descend into the water and remain indefinitely. See also STAGE SCENERY; STAGE LIGHTING; THEATER.

A. E. K.

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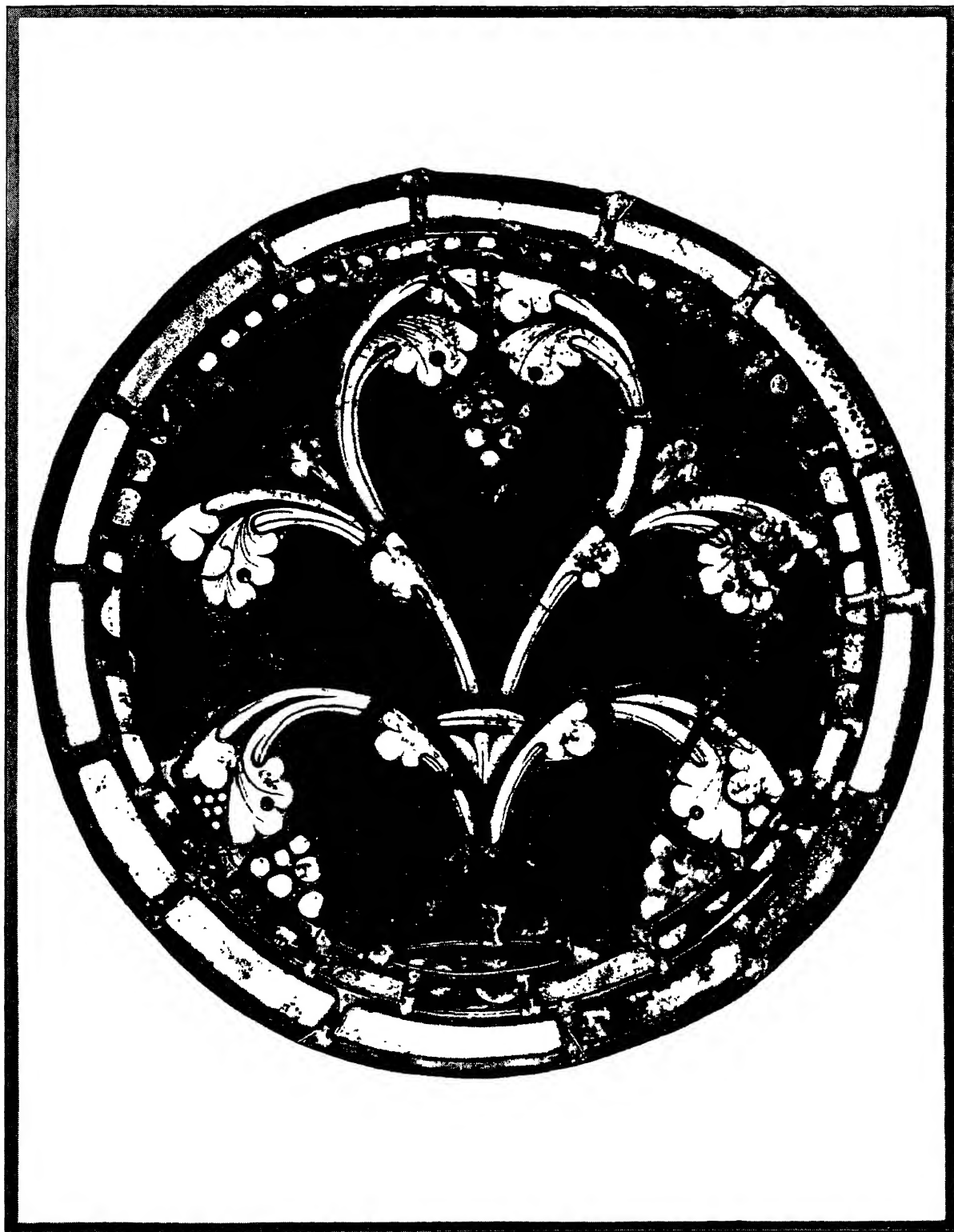
STAGE SCENERY. Sophocles is accredited by Aristotle with having invented painted stage scenery

about the middle of the 5th century B.C., though there is no actual proof that painted scenery was used at all by the Greeks. In any case its use was limited and confined to three conventional types of setting: 1. the Tragic scene representing the façade of a pretentious building adorned with statues and other architectural embellishments, and always containing five entrances; 2. the Comedy scene consisting of the façades of two or more private houses with practical doors and windows; 3. the Satyric scene representing a woodland glade. Interior settings were never used. The style of painting employed was totally unrealistic; probably of the kind found in the backgrounds of Greek vases, where several conventionally painted trees suggest a forest. No attempt was made to create illusion or to convey ideas of depth or distance. The settings of the Romans were in every respect an imitation of the Greek, though probably more realistic and certainly more ornate. About the time of the Imperial age, the Tragic setting assumed a plastic form and was eventually incorporated as a permanent architectural feature of the building by forming the back wall of the stage. The Romans used a front curtain, probably of some rich fabric; it was raised from a slot in front of the stage floor by means of wires or light ropes, and dropped back into this slot when not in use.

Middle Ages. MYSTERY AND MIRACLE PLAYS were performed outdoors on temporary platforms on which were arranged in an irregular semi-circle a series of scene booths representing the various localities required by the play. These stations naturally varied according to the text, but one convention in their arrangement seems to have been invariably adhered to, namely, that Heaven and Hell be located at either extremity of the series, respectively to the left and right of the spectator. The character of the settings was usually imitative of the contemporary architecture of the day and was totally non-realistic, being merely a conventionalization of the place represented, and entirely devoid of historic accuracy. The scenes were accompanied by unbelievably elaborate and difficult mechanical effects such as flying angels and devils giving off fire and brimstone. Such effects were shown in broad daylight and at close range. No front curtain was used, since there was nothing in the way of a proscenium to hold it in place. The action of the play proceeded from one station to another, while all of the settings of the series remained in full view, thus forming the so-called "simultaneous" scene.

The Renaissance. Shakespeare's stage made no use of scenery. The only thing in the nature of a stage setting seems to have been a movable tapestry or drapery which hung between the outer and the inner stage; it was probably intended mainly to provide a hiding place whenever such was required by the play. This drapery was sometimes of black material when used for tragedy. A similar stage with its single drapery background (either painted or unpainted) had been used by the *commedia dell'arte* from time

STAINED GLASS



COURTESY METROPOLITAN MUSEUM OF ART

EARLY ENGLISH STAINED GLASS MEDALLION

Rounded English colored glass, executed in the 13th century. The example is unique for its absence of pictorial subject.

immemorial and probably served as a model for Shakespeare.

Both the stage settings and the theaters of the Italian Renaissance were materially influenced by the Roman remains. A perfect example of this exists to-day in the Teatro dell' Olimpico at Vicenza, Italy, designed by Andrea Palladio (1518-80). This theater has a permanent plastic stage setting forming the main wall of the back of the stage, directly imitated from the Roman. In addition, however, behind its arched doorways, plastic stage scenery streets run off into perspective. These streets were probably added at some time after the theater's completion and were probably not a part of its original scheme. In any case one has here a very interesting innovation of the Renaissance. Another architect of this era, Sebastiano Serlio (1475-1554), author of *Regole Generali d'Architettura*, 1537, has left sketches showing three types of setting evidently intended for contemporary plays or translations from the antique; one type for tragedy, one for comedy and one for satire, thus showing that the tradition of antiquity was revived and its conventions in the matter of stage setting retained. Serlio's designs place the tragic scene in a pretentious public square; the comedy scene in a slightly less pretentious street, and the satiric scene in a sylvan glade with several rustic huts. It is thus perfectly evident that Serlio's designs are merely modifications of the conventional scenic formula used originally by both the Greeks and the Romans. In further imitation of the Roman setting, those of the Italian Renaissance were often three dimensional. It is not exactly known what date the Italian setting was reduced to the matter of boards and canvas painted in opaque water-color with a water and glue medium. This system was certainly in use by the time of Serlio, and has persisted to the present day. Since elaborate plastic architectural scenes were being done as late as the 17th and 18th centuries, it is only reasonable to suppose that the two systems flourished side by side. In any case INIGO JONES (1573-1652) saw settings of this sort when he visited Italy about 1600 and again in 1614, and was directly responsible for their first use in England, where he designed many such settings for Masques and plays. Eventually the Italian stage settings, both of the plastic and of the painted-perspective "wing," "flat" and "border" type (hereinafter referred to as the "painted-perspective school"), were either imported or imitated or both all over Europe. This wholesale distribution and influence was mainly due to one famous Italian family of scene painters named Galli-Bibiena, father, sons and grandsons, who designed and painted innumerable settings not only in Italy but also in France, Austria, Spain, Germany and other countries from 1625 to 1780. The Bibiena apparently designed settings both of the plastic type and of the "painted-perspective school." Their settings may be said to be characterized by a copious use of the ornate style of late Italian baroque architecture and sculpture—spacious proportions, bold perspective and splendor.

The scenic tradition of the Bibiena was continued long after their death, and persists in the minds of scene-painters even to-day.

Modern Stage Scenery. Reaction against the "painted-perspective school" and its artificiality began about the middle of the 19th century, but the revolts against it were few and comparatively unimportant. Its greatest enemy came in the form of the realistic school of playwrighting prevalent during the last two decades of the century; the very nature of the plays of this school naturally demanded a more realistic type of setting, especially since many of the scenes now required were interiors. The realistic school of stage scenery thus came about. In England it may be said to have reached its apogee under HENRY IRVING (1838-1905) and HERBERT BEERBOHM TREE (1853-1917); in Germany under MAX REINHARDT; in Russia under Stanislavsky, and in America under DAVID BELASCO. The realistic school was not without its virtues; for one thing it led to more painstaking care in the matter of detail and greater pains on the part of producers to achieve a more unified whole. But its greatest defect was probably its tendency to carry realism to a point where it attracted attention to itself as such and, in the matter of scene painting, to fill the stage with settings that attracted too much attention to themselves for the same reason.

Finally about 1900, as a reaction to the abuses of both of the great schools of stage scenery, the western world witnessed a new and drastic revolution in stage setting. This first took form in the persons of Adolph Appia (b. 1862) an Italian-Swiss artist, and EDWARD GORDON CRAIG (b. 1872), an English actor-manager-artist. Both of these men, each more or less independently of the other, developed and published certain ideas of a new stagecraft based on simplicity and the use of lights and plastic forms in setting as opposed to realism and painted perspective. Reduced to its simplest terms, Appia's notion was to achieve beauty and simplicity of setting by a combination of carefully arranged lights and plastic architectural masses, in order to fuse the three dimensional forms of the actor and the setting into a uniform whole, and thus give the actor's movements and attitudes their proper values. Appia's *La Mise en scene du drame Wagnerian* and his *Die Music und die Inszenierung*, published 1895 and 1899, respectively, are among the most important documents in the annals of modern stagecraft. Craig's scheme was, generally speaking, to achieve perfect unity in a production through the medium of one man, the "regisseur," a superman who would combine the qualities of dramatist, actor, director, scene designer and electrician. His amazingly dignified settings are mainly characterized by the use of huge pylons, long flights of steps, a variety of levels for acting and the use of towering folds of drapery, all of these used either separately or in combination. His settings are entirely devoid of palette painting and stage perspective. Craig's activities as a designer began between 1900 and 1905. The influence of these pioneers was mani-

fested first in Germany and later in Russia, but it gradually spread to America and in a slightly less degree to England and to France. One of its earliest and greatest disciples was the famous Russian artist, LEON BAKST (1866-1925); although Bakst adapted the notions of the new stagecraft to palette painting on an immense scale intended mainly for spectacular theatrical displays such as the Russian Imperial Ballet. The new school of stagecraft as set forth by Appia and Craig has been made possible to no small degree through recent improvements in electric lighting and its control by dimmers, as well as by the invention of the sky dome and of various devices for making quick changes of scene, such as the revolving stage, originally a Japanese invention, and the wagon stage.

The modern movement toward a new stagecraft has in the meanwhile been steadily developing and expanding over all Europe and in the United States. Based on simplification and suggestion as opposed to the over-decorated, over-detailed, over-painted, over-perspectivised stage settings of the 19th century the new stagecraft has taken a long step forward toward synthesizing and fusing the setting and the lighting with the actors and the play. Stylization, symbolism, abstraction, expressionism and all the other "isms" have been elaborately experimented with during 1900-30 in the theater, often with extremely interesting results. A restrained and a more tasteful realism has also developed. The pioneers of the new movement have every reason to feel gratified. W. T.

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STAGG, AMOS ALONZO (1862-), physical director and football coach, was born at West Orange, N.J., Aug. 16, 1862. He played on the Yale football team in 1888-90, and in 1889 was selected by the late Walter Camp as left end of the "all-American" team. In 1892 he joined the faculty of the University of Chicago as director of the department of physical culture and athletics. As football coach he devised novel plays, for the first time using the ends behind the line to carry the ball like backs, or employing them for interference. Stagg was appointed to the football rules committee in 1904, and was appointed member of the American Olympic Committee in 1906, serving at all subsequent Olympic meets. With Walter Camp he is credited with developing football to its present-day stature in collegiate athletics. In 1914 the University of Chicago named Stagg Field in Stagg's honor.

STAGGERBUSH (*Neopieris mariana*), a small, smooth shrub of the heath family poisonous to livestock, especially to sheep. It grows in sandy soil near the coast from Rhode Island to Florida and extends westward to Tennessee and Arkansas. The shrub grows 1 to 4 ft. high bearing thin oblong leaves and showy nodding white flowers on leafless branches.

STAGHORN FERN (*Platycerium bifurcatum* and others), a perching (epiphytic) fern of striking appearance, native to Australia and widely cultivated in greenhouses and conservatories. The gray-green, silky-hairy plant bears round, shield-shaped, parchment-like sterile leaves (fronds) that lie prostrate near the support on which they grow, and antler-shaped erect or spreading, drooping fertile leaves (fronds), 2 to 3 ft. long.

STAINED GLASS, a term applied to the use of pieces of glass into which color has been fused, leaded together to make a translucent design. The actual origin of the art is not known, but it probably came from the East. In his celebrated Latin thesis, written in the 12th century, the monk Theophilus calls it a "French art," and the Abbé Texier (1802-71) believes that its European beginnings were in the neighborhood of Limoges, where Byzantine influence was already active in the fashioning of the famous enamels. Colored glass was mentioned by Greek and Latin writers as early as the 4th century. The first reference, however, to pictorial stained glass windows is found in a notation of the rebuilding of Rheims Cathedral in the years 969-988. The cathedral of Augsburg in Germany contains glass which dates from the 11th century and is probably the oldest in existence. The great development of stained glass, however, coincided with the development of Gothic architecture. During the RENAISSANCE, in the 16th century, stained glass flamed with great pictorial beauty; then the art fell into decadence until the Gothic revival of the 19th century brought it into modern and continuing practice and favor.

Stained glass can be studied satisfactorily from the 12th century, of which period a number of fine examples still remain. During the 12th and 13th centuries the color was put into the glass in its molten state, and the glass was known as pot metal; the only color painted on the surface was the brownish grisaille, which at that time was used only for outlining the design. The lead strips which joined the pieces of glass together had then, as is generally the case in the best stained glass, an important part also in the design's traceries. The earliest windows were decorated with large single patterns, usually figures, but about the middle of the 12th century the medallion became popular; medallions, varying in shape, themselves containing small pictures, formed the windows' large designs. The stained glass window of these centuries may best be described as a mosaic in translucent glass. The finest 12th-century window still in existence is the famous "Jesse window" in the west front of Chartres cathedral. Stained glass of the 13th century is found with great richness in France, in England, notably in York and Canterbury cathedrals, in Germany and also in the church of St. Francis at Assisi in Italy; the most complete and beautiful, indeed the perfect, collection of 13th century glass in the world at the present time is that of the Sainte Chapelle in Paris.

In the 14th century two new developments appeared in stained glass technique, and the transition to Deco-

rated Gothic architecture brought a change in fenestration and in the windows themselves. The first technical discovery was the use of a silver stain to paint a clear yellow tone on the surface of the glass. The second was the making of what the French called *verre doublé*, or lined glass, by plunging a bubble of glass of one color into another color to obtain a new tone. Invented in the 14th century, this process became very popular in the century following. In the 14th century the demand for more light in the churches not only altered the arrangement of the windows, but brought an extension in the use of grisaille, and the innovation of architectural backgrounds or "canopies" within the windows in light-admitting tones of glass. Colors were generally brighter and pieces of glass were larger; the design itself was emphasized to a greater extent, and tended more toward the clearly pictorial. At this time stained glass began to be desired in secular buildings. The 15th century brought little positive change: more clear glass was used, and light-admitting details were dwelt upon. Beautiful glass of the 14th and 15th centuries is found all over Western Europe: In England, France, Germany, where Cologne, Ulm and Munich may be especially mentioned; in Austria, Italy, Belgium, Spain and Switzerland.

With the beginning of the 16th century the Renaissance brought a decided change in stained glass, as in architecture. The colors were now enameled on the glass, and fired in. The glass itself was thinner. Renaissance architecture, instead of Gothic, was pictured in the "canopy" background of pale glass. But the outstanding change by which 16th-century glass may be immediately recognized was the sudden use of perspective in the making of windows which had become almost entirely pictorial. The decorative use of the leads was practically abandoned at this time. During the 16th century glassmaking flourished in Belgium and Holland, as well as in the localities where it had been developed earlier, and fine glass of this period is to be found in these countries. Probably the best and richest collections of 16th-century glass windows in existence are those of the Church of St. Foy at Conches in France, and the church at Fairford in Gloucestershire, England.

After the ensuing period of virtual eclipse, the art of stained glass owed much, in its modern reflowering, to the Pre-Raphaelites in England, especially EDWARD BURNÉ-JONES and WILLIAM MORRIS. In the late 19th century JOHN LAFARGE did notable work in the United States. At the present time beautiful stained glass windows are being made for churches according to the old traditions. Along with the revival of the traditional art, the 20th century has brought the effort to modernize stained glass in design, fenestration and purpose, in order to harmonize it with modern architecture. This use of stained glass is, of course, secular for the most part; it ranges from conventionalization of traditional pictorial effects to decidedly modernistic decoration.

The colors produced in GLASS are of a mineral na-

ture, and are in the majority of cases permanent, thus differing from those applied to fabrics which are organic in nature and may change in time. Colors may also be applied to glass by treating the surface and firing the glass in kilns. The term, stained glass, is often a misnomer, for most of the glass employed in ornamental windows carries its color throughout, and not merely on the surface.

Glass used in ornamental windows is blown into cylinders (see WINDOW GLASS). After these are split and flattened, the colored sheet which results is cut into small sections, and the colors are sorted, yielding a variety of tones. These are selected by the artist according to his needs and the individual pieces are set in lead or other metals.

Stained glass windows may also include designs which are painted upon colorless glass plates in mineral colors, and afterwards fired so that the transparent enamel melts into the surface of the plate.

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STAINLESS STEEL. See CHROMIUM STEELS.

STALACTITES, a mineral formation resembling icicles frequently found in LIMESTONE caves. Water circulating through limestone beds dissolves some CALCITE and reaching the roof of a cavern, drips through. As the drops hanging from the roof evaporate slightly, they deposit some of the dissolved calcite. In time this accumulation may assume large proportions, and depend from roof to floor like a huge icicle. Pinnacles built up from the floor by falling drops are called STALAGMITES. Well-known stalactitic deposits are found in the Mammoth Caves of Kentucky, and the Carlsbad Caverns of New Mexico. See also ONYX; TRAVERTINE; ALABASTER; TUFA.

STALACTITE WORK, a type of Mohammedan ornament consisting of small projecting forms with niche-like hollows, used particularly on the undersides of pendentives, niche heads and cornices, and so called because the pendent vertical edges fancifully suggested stalactites. The origin of the form is possibly to be sought in the hollowing out of the underside of projecting corbel stones. See MOHAMMEDAN ARCHITECTURE.

STALAGMITES, calcite formations frequently encountered in LIMESTONE caverns. They consist of pinnacle-like masses projecting upward from the floor, often assuming fantastic forms and not infrequently coalescing with STALACTITES to form columns and "organ-pipes." Stalagmites are built up by deposition of CALCITE from water dripping onto the floor of the



PERSIAN STALACTITE WORK
OVER MAIN ENTRANCE OF
ROYAL MOSQUE, ISFAHAN

cave, similar to the mode of formation of stalactites depending from the roof. Both are classed as forms of TRAVERTINE, and thick accumulations are sometimes cut for marble ONYX or cave onyx, and for oriental ALABASTER.

Stalagmites are common in limestone caves, as in Kentucky, Indiana, and the Nile Valley. See also MARBLE; TUFFA.

STALIN, JOSEPH VISSIARONOVICH, DJUGASH-VILLI (1879-), general secretary of the Russian Communist party, was born in a mountain village in Georgia in the Caucasus, in 1879, the son of a poor cobbler. At the instigation of his mother, who ardently desired that her son should become a priest, Stalin entered a theological seminary at the age of 18 but was soon expelled. Coming under the influence of the teachings of Karl Marx, he joined the revolutionary groups. Of strong physique and indomitable will this shrewd dark-haired Georgian with his enigmatical smile soon became a leader of the revolutionary fighting squad of the Caucasus. Repeated hold-ups, especially the notorious "Tiflis Expropriation" of 1907 in which several scores were killed, not only procured money to carry on the revolutionary propaganda but made him a marked man. He subjected himself strictly to the secret party discipline and wandered over Russia distributing literature, spreading propaganda and making converts. He organized strikes and led in demonstrations, was arrested and imprisoned again and again, escaping from Siberian prisons four times before the revolution.

The overthrow of the Czar in 1917 found him again in exile in Siberia. He immediately returned and threw himself into the work of organizing the Bolshevik forces, profiting by the experience gained during the revolution of 1905, when he and Lenin organized Soviets among the workers and peasants. Indeed the ultimate victory of Lenin and the Bolsheviks was in large measure due to the masterly organizing ability of Stalin. After the *coup d'état* of Nov. 7, 1917, he was made commissar of nationalities. He was also chosen secretary general of the Communist party and in this capacity he slowly built up the party machine in furtherance of his own interests.

Stalin's real power began with Lenin's illness and continued to grow till he found himself the strongest member of the new triumvirate which succeeded Lenin after his death in 1924. By 1927 he had risen to the position of a dictator. Trotzky and his friends alone dared to oppose him and in the struggle that ensued Trotzky was not only worsted but banished, first to Siberia and then to Constantinople (1929). The conflict, like those of the Reign of Terror in the French Revolution was not so much over the much discussed political differences and Trotzky's insistence on carrying out plans of "uncompromising communism" as it was a struggle for power. This became clear later when Stalin, secure in his position, himself pushed the program of col-

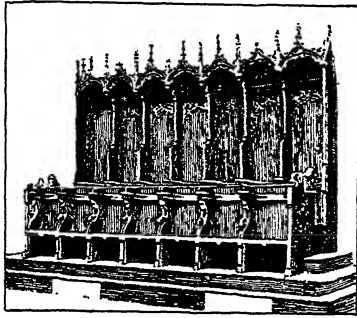
lectivism against the *kulaks* (well-to-do peasants), and inaugurated the famous Five Year Plan for collectivization of Russian agriculture and high pressure industrialization especially in the heavy industries of the country. In the meantime, he reigns supreme through his control of the executive committee of the Communist party and the large and loyal following in the party as a whole.

STALIN, formerly Yuzovka, a large town in the southeast Ukraine S.S.R., an industrial center especially noted for its metallurgical works. The city became important in the late 19th century when the Russian government granted a concession for the manufacture of rails to a British capitalist who exploited the proximity of the town to the Donetz coal basin and adjacent territory rich in iron and manganese. European capital was profitably invested, but the industrial project received a setback in the 1917 revolution. Under the subsequent Soviet régime, the industrial potentialities of Stalin were increasingly exploited. Pop. 1926, 105,857.

STALINGRAD, formerly Tsaritsin, administrative center of Stalingrad district in the Lower Volga Region of the R.S.F.S.R., in southeastern European Russia. The town rises from the terraced right bank of the Volga in the hilly steppe region intersected by the river Tsaritsa. Supplying commodities to southeastern Russia and the whole Volga territory, this community owes its increasing prominence in trade and industry to its situation on the Volga where it most nearly approaches the Don. Railways link the rivers here and also give Stalingrad communication with Moscow and the Caucasus; it is a leading transshipment point, therefore, for goods to and from internal districts and the Caspian Sea. It is the Volga's chief timber market and the headquarters for the re-sale of fish and caviar from Astrakhan. Industrially outstanding are a great tractor plant, oil refineries, sawmills and machine works. This vicinity was a Tatar stronghold during the 13th century; upon its capture by Russia a fort was built in the last part of the 16th century for protection against nomadic tribes. Stalingrad was the scene of intensive fighting between White and Red armies from 1917 to 1919. The former monastery is now a Children's Home. Pop. 1926, 143,110.

STALL, in architecture, a separate compartment of a larger element, such as the stalls for animals in stables or barns; also one of a series of seats for the choir and clergy of a ritualistic church, especially when these are situated in the choir or chancel. Stalls are usually arranged in two or three rows on each side parallel to the long axis of the church, and facing each other across the open central area. Each row is raised a step above that in front, and the rear rows are enriched with a high back decorated with canopies and cresting. The seats are usually arranged to fold up, and sometimes a little bracket, or *miserere*, is carved on the underside of the seat to furnish partial support during the period when the choir is compelled to stand. Choir stalls received their highest medieval

development in 14th century England and 15th and early 16th centuries in France, e.g., Ely Cathedral and Amiens Cathedral. They were also favorite places for



COURTESY M. M. OF ART

OAK STALL CARVED IN RELIEF
German, late 15th century

rich decoration in Renaissance Italy and Spain, and Baroque Germany.

STAMFORD, a manufacturing and residential city in Fairfield Co., Conn., situated on Long Island Sound, 32 mi. northwest of New York, and served by the New Haven Railroad. The city is noted especially for its manufacture of locks, bolts and hardware. In 1929 the total of all manufactured products amounted approximately to \$35,000,000; the retail trade reached \$33,288,289. Stamford, being within commuting distance of New York, is a popular summer home for New York business men. Shippan Point has many fine residences, private beaches and a yacht club. Several well-known private schools are located here. When Stamford was first settled in 1641 by a colony from New Haven, it replaced the Indian village Rippowam. It was incorporated as a borough in 1830 and was granted a city charter in 1894. Pop. 1920, 35,096; 1930, 46,346.

STAMMERING. Stammering, or stuttering, is an involuntary disturbance of speech, which is marked by repetition of sounds or words, or by a temporary inability to proceed.

Stammering usually has its onset in childhood. It is roughly four times as common in boys as in girls. The speech impediment may follow fright, shock, nervous fatigue, over-stimulation, illness, and imitation of stammerers or association with them. The speech disturbance is variable in its intensity, and during childhood it sometimes disappears for weeks or months at a time, and then returns with its former intensity. Occasionally it disappears permanently.

Stammering is variable in its manifestations, as well as its severity. A stammerer who was formerly bothered with certain consonants may now have difficulty only with vowels, or the consonants themselves may change from time to time. There are certain situations that are difficult for stammerers. For instance, the stammerer may talk badly when introducing people or when speaking over the telephone; on the other hand, talking when alone may be easy, or talking and reading in unison with other people. The

stammerer is never bothered by his impediment in singing, and seldom when talking to an animal or an infant. The confirmed adult stammerer experiences marked fear when stammering, this fear amounting in its intensity to mental suffering.

The exact cause of stammering is not known. In the earlier days of medicine it was thought to be due to various defects in the anatomy of the speech organs. Later it was believed to be caused by disturbance in the function of these organs, and especially by spasm in the muscles of speech. Nowadays it is rather generally agreed that the cause is psychological, arising in the mental process of speech and not in its physical production by the lips, tongue, and vocal cords. The history of stammering shows that various theories of cause and treatment have had vagues that were unwarranted. This makes one cautious in accepting any of the newer psychological theories until their validity has been thoroughly tested.

The treatment of stammering is educational and should be carried on only by competent instructors. Advertising quacks are to be avoided. Successful treatment of stammering requires attention to the emotions, the thinking processes, and the act of speech itself. Excitement and haste should be avoided. Composure should be cultivated. Attention should be given to the thought before speech is attempted, and the words should be formed in a clear and orderly manner in the mind, in order that they may be spoken in this manner at the lips. On the physical side of speech emphasis is placed on quiet, slow talking, and attention is usually given to the matter of a preliminary breath before the stammerer commences to speak.

Young children are often found to stammer only when they speak in loud high-pitched voices during excitement. In such cases stammering can often be corrected by requiring them to speak quietly and slowly. Stammering children should have ample sleep and rest, and should not be exposed to excitement and over-stimulation. C. S. B.

STAMP, SIR JOSIAH CHARLES (1880-), British economist, was born at London, June 21, 1880. In 1896 he entered government service. Stamp sat on the Reparation Committee on German Currency in 1924 and the Experts' Committee on Reparations in 1929. In 1925 Stamp was elected president of the executive of the London, Midland & Scottish Railway. He was knighted in 1920. His publications include *Wealth and Taxable Capacity*, 1922, and *The Financial Aftermath of War*, 1930.

STAMP ACT, an act of Parliament, signed by George III Mar. 22, 1765, providing that bills, bonds, leases, insurance policies, broadsides, diplomas, certificates and legal documents could be written only on stamped paper; that stamps be affixed to all books, except schoolbooks, newspapers, pamphlets, calendars and playing cards; and that, at the discretion of the prosecuting official, the right of trial by jury be denied to offenders. It is a supreme example of a nuisance tax, one that attempts to secure revenue by

petty, irritating means. When the news of its passage reached the colonies, in May, opposition became manifest everywhere, on the ground that inasmuch as the colonies were not represented in the British Parliament that body had no legal right to tax the colonies. The announcement of the arrival of the stamps in America was the occasion of riots and disorders; the stamp distributors were nearly everywhere compelled to resign. Resolutions were passed by several colonial assemblies; and, at the suggestion of James Otis, the Massachusetts General Court issued a circular letter, June 8, calling a general convention to discuss the common grievances of the colonies against the Crown. That convention, the Stamp Act Congress, composed of delegates from nine colonies, met in New York in October, and issued a "Declaration of Rights and Grievances," and memorial addresses to the King and each House of Parliament. The outcry against the act, increased when it technically became effective on Nov. 1, was such that on Mar. 18, 1766, Parliament repealed the act, but reasserted the offensive principle of its power to tax the colonies in the Declaratory Act, Mar. 7, 1766.

STAMP BATTERY, essentially, a group of huge pestles, usually five, working in a large iron mortar. They are raised mechanically and allowed to fall by their own weight. Stamps are used for fine crushing work as in **AMALGAMATION** of gold ores. *See* **ORE TREATMENT**.

STAMPINGS, DROP, should be distinguished from formed metal articles and also from **FORGINGS**. The production of a drop stamping involves two steps. First is the production of a blank in which operation the metal is cut to the desired shape from a sheet or strip. This blank is then placed under a drop in a definite position. There is then dropped onto it from a considerable height and with a considerable impact a die so shaped as to produce the design or shape desired in the finished article.

By this method it is possible to produce products which have embossed in them a design or which for purposes of strength may be corrugated. It is also possible to produce an article having a variety of gauges as for instance where it is desired to have an article having in its greater part a given thickness of metal which gradually decreases in thickness on the edges commonly known as a beveled edge.

W. S. Ro.

STAMP TAXES, taxes originating in the idea that it lent dignity to or made a contract more binding if some government official put his stamp of approval on the document in which it was written or recorded. This led to the use of stamped paper sold by the government for such documents. Later, when adhesive stamps, like postage stamps, were invented it came to be a very easy way of collecting many small fees or taxes by requiring that stamps be attached to documents recording sales or contracts. To make sure that they would be paid it was decreed that the sale or contract would be invalid unless the stamps for the legally required amounts were attached and can-

celled. Since a multitude of small sums may make, in the aggregate, a very large sum, stamp taxes on deeds, invoices, tickets, mortgages, notes, bonds, bank checks, shares of stock or powers of attorney can be made very remunerative to the government and are inexpensive to collect. They are likewise great nuisances and never popular.

A stamp tax proper should not be confused with the use of stamps, as on containers of tobacco, to show the payment of a tax which in its fundamental character is different. C. C. P.

STANCHIO. *See* **Cos.**

STANDARDIZATION, one of the most significant and characteristic features of the industrial development of the past century and a half as well as an influential factor in shaping the course of that development. It has involved the production of each commodity in units of absolute uniformity in so far as can be mechanically attained and the reduction of manufacturing processes to a uniformity as nearly perfect as tools, working conditions and men will permit. This has been accomplished by drawing up exact specifications, measurements and descriptions of the goods to be produced and by defining exactly the processes and often the motions involved in production.

The result has been the production of goods so standardized in very large quantities, while at the same time the growth of **MASS PRODUCTION** has stimulated attempts toward increased uniformity of goods and manufacturing methods. It has led to a more intensive and detailed division of labor as well as to an increased mechanization of industry. The amount of goods turned out has thus been vastly increased and the **COST OF PRODUCTION** greatly decreased.

While standardization has been a feature of the development of every highly industrialized nation it has been peculiarly characteristic of that of the United States. There the movement was greatly accelerated during the decade immediately after the World War when it was sponsored by various organizations including groups of manufacturers associated to promote efficiency, **TRADE ASSOCIATIONS**, and the Federal Department of Commerce. In this phase it took the form of the elimination of shapes, sizes and types of articles, which were but little used or which could be readily superseded by other types as well as of a more rigid insistence upon absolute uniformity of parts and units.

Standardization is subject to considerable criticism on the ground that it kills individual initiative and inventiveness, prevents the development and satisfaction of individuality in consumers' tastes, and tends to a dead level of monotony in production and consumption. Over against these criticisms must be set the greatly decreased cost of production and an added measure of security felt by the consumer in the quality of the goods he buys.

In the field of agricultural products standardization has taken the form of the careful definition, by enumeration of supposedly desirable commodity character-

istics, of standards or grades into which the different units grown may be classified. A buyer of such articles thus gains assurance as to the character of goods in which he is interested and may purchase by description in terms of class or grade rather than by examination which is always costly, often unsatisfactory and sometimes impossible. Standards and grades are now established by the Federal Government for most widely distributed agricultural commodities and for many such products governmental inspection service is provided. *See also SIMPLIFIED PRACTICE.*

R. S. A.

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STANDARD OF LIVING—a phrase indicating the comforts and luxuries to which an economic group or class is accustomed and which it relinquishes only reluctantly. Classifications differ, but social economists generally distinguish four levels: 1. The pauper or poverty level, crowded living quarters, food insufficient to maintain working strength and health, and in which the least unusual expense produces dependence; 2. Minimum of subsistence level, enough to eat, but no provision for expenditure on amusement or other extras; 3. Minimum health-and-decency level, four or five rooms for the family of five, an allowance for amusements and incidentals; the family will generally be self-sustaining; 4. Minimum of comfort level, (American standard of living, something for insurance, more for sundries than in other budgets; it is an ideal reached by relatively few working class families). Particularly during the World War, the standard of living concept was made the basis of wage awards by government and arbitration boards; generally the comfort level was the objective of the workers' appeals, though sometimes the health and decency level was considered adequate in the case of the unskilled. Three important earlier studies of the standard of living were those of Louise Boland More, 1903-05, who investigated the expenditures of 200 working class families in New York City with an average income of \$851.38; in 1901 the United States Bureau of Labor studied 25,440 families in 33 states, with a mean income of \$749.50; in 1909, R. C. Chapin published the results of an intensive study in New York City, concluding that "An Income under \$800 is not enough to permit the maintenance of a normal standard. An income of \$900 or over probably permits the maintenance of a normal standard at least as far as the physical man is concerned." In 1918 Prof. F. W. Ogburn, in charge of the Cost of Living section of the National War Labor Board, working from data pertaining to eastern industrial centers, concluded that a health and decency budget for the United States as a whole would require that the family of man, wife, and three children under 14 have an income of \$1,760.50.

It has been estimated that a man at ordinary physical labor requires 3,500 calories a day, that his wife requires 0.8 as much, a boy of 16, 0.9 as much, a child from six to nine, 0.5 as much. Inquiries have

revealed that few working class families reach this desirable caloric content, often from lack of income, often from bad judgment in expenditure for food, often because purchase in small quantities prevents true economy. Substitutions in the budget are easier for families with a higher standard of living than for those with a lower standard. American experience seems to indicate that with increase of income the proportionate expenditure on food decreases from 50% of the total to less than 40%; that the percentage expenditure for clothing tends to increase; that the percentage for rent does not change greatly; proportionate expenditures for fuel and light decrease; expenditure for sundries and "culture wants" increase absolutely and relatively. A study conducted by the National Industrial Conference Board in 1927 into the cost of a standard budget "intended to represent a fair minimum standard of living for an American wage earner, his wife and two minor children" in 12 cities of large, medium, and small size, showed a range from \$1,659.84 in New York to \$1,441.96 in Marion, Ohio, a difference of 15%. The smallest variations were found in prices of food and clothing, 12 and 15% respectively.

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STANDARDS, NATIONAL BUREAU OF, a bureau of the DEPARTMENT OF COMMERCE "charged by law with the custody of the standards, the comparison of the standards with those used in science, industry, technology, commerce and educational institutions; the testing and certification of standard measuring instruments; the solution of problems arising in connection with the standards; the determination of the physical constants and properties of materials; and other investigations authorized by Congress." Investigations which it carries out are concerned with practically all industrial fields.

Its work falls into two major classes: scientific and technical research and testing; and the establishment of commercial standards. The research and testing division include: electricity, weights and measures, heat and power, organic and fibrous materials, metallurgy and ceramics. The commercial standards division: simplified practice, building and housing, specifications, commercial standards and coöperation with such organizations as the American Marine Standards Committee and the Federal Specifications Board. Other divisions are concerned with the administrative, maintenance and construction work of the Bureau plants.

The Bureau of Standards was established by act of Congress on March 3, 1901. The Bureau functions for the federal and state governments and sometimes, for reasonable fees, for the general public. During its 30 years of existence, it has contributed much to industrial development as well as to the establishment of national and international standards of WEIGHTS AND MEASURES.

STANDARD SQUARE, a unit of measure of area used in the mechanical arts, consisting of a square ten feet on a side, or comprising 100 sq. ft. It is commonly employed in measuring flooring and roofing.

STANDARD TIME. See TIME, STANDARD.

STANDISH, MILES (c. 1584-1656), American colonist, was born in Lancashire, England about 1584. Longfellow's poem has tended to make a legendary character of Standish, and to obscure the actual career of the man. Apparently the rightful heir to a



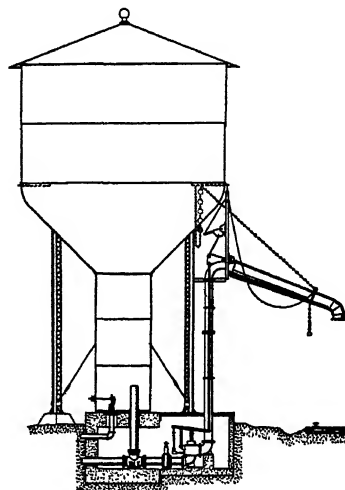
MILES STANDISH HOUSE, DUXBURY, MASS.

large fortune, he was in some way deprived of his heritage. He attained the rank of captain with the English army in Flanders, and although not of the same religious beliefs, he joined the Pilgrims in Holland, 1620 and sailed with them to England and thence to America. His army experience led to his selection as the military leader of the colonists, which he remained until his death. With a mere handful of armed men, who were not soldiers, he protected the colony from the Indians by the exercise of tact when possible and at other times by opportune sanguinary reprisals against obstreperous Indians. Standish thoroughly explored the region of Plymouth Plantation, and by his fortitude and wise counsel aided the colony during its early hazardous years. The town of Duxbury was founded by him and others in 1632. Standish was married twice, but little authentic information is known of these marriages, and the description of his courtship in Longfellow's poem is probably apocryphal. He died at Duxbury, Oct. 3, 1656.

STANDPATTERS, ultraconservative members of the Republican party in the United States, opposed to the PROGRESSIVE PARTY policies. The name was probably derived from a statement by Senator MARK HANNA, 1900, that the Republican party should "stand pat," i.e., admit no change, on the principle of high protective tariff. The standpatters, led by Senator Aldrich and Joseph G. Cannon, Speaker of the House, represented vested interests, "big business," in conflicts with President Roosevelt and the progressive element of the Republican party. Their control of the party machinery enabled the standpatters to renominate President Taft in 1912.

STANDPIPES are tanks usually from 10 to 30 feet diameter and from 35 to 100 feet high, or elevated tanks holding not less than 30,000 gallons, connected with WATER DISTRIBUTION systems. They aid

in preventing sudden and frequent fluctuations in pressure and for limited storage. They are filled during hours of least consumption and then furnish supply for periods of low pressure during hours of maximum demand. They are useful adjuncts to a WATER



SECTIONAL VIEW OF A STANDPIPE USED FOR RAILROAD WATER SERVICE

SUPPLY system in the vicinity of large institutions and in elevated districts. E. E. W.

STANFORD, LELAND (1824-93), American capitalist and philanthropist, was born at Watervliet, N.Y., Mar. 9, 1824. He prepared for, and was admitted to the New York bar, but moved to California after the gold discoveries, and in 1856 went into business in San Francisco. Later he became president of the Central Pacific Railway, which he helped to organize. He was governor of California, 1861-63, and U.S. Senator, 1885-93. With gifts amounting to \$22,500,000, he founded the Leland Stanford Jr. University at Palo Alto, Cal., in memory of his only son, who died in 1885. He died at Palo Alto, June 20, 1893.

STANFORD UNIVERSITY or **THE LELAND STANFORD JUNIOR UNIVERSITY**, a coeducational institution, situated in the Santa Clara Valley, at Palo Alto, Cal., 30 miles southeast of San Francisco. Founded in 1885 by Leland Stanford and his wife, Jane Lathrop Stanford, as a memorial to their son, Leland Stanford, Jr., the university was opened Oct. 1, 1891. Its first president, 1891-1913, was Dr. DAVID STARR JORDAN. The schools of Stanford include those of Letters, Medicine, Law, Engineering, Education, Physical Sciences, Biological Sciences, Hygiene and Physical Education for Men, Social Sciences and a Graduate School of Business. The academic year consists of three quarters of approximately 11 weeks each, the fourth quarter constituting the summer session. An amendment made by Mrs. Stanford in 1903 limits the number of women students to 500. The buildings of the university, situated on a hand-

some campus of 1,500 acres, are built of buff sandstone in the Spanish Mission style, with open arches, long colonnades and red-tiled roofs. The Inner Quadrangle comprises 12 one-story buildings connected by an open arcade, and the Memorial Church; the Outer Quadrangle includes 14 buildings of the same style. There are other important buildings outside the quadrangles. The library, containing 545,175 volumes, includes Pres. Hoover's War Library. Other special features are: the Hopkins Marine Station, at Cabrillo Point, Pacific Grove; the Harris J. Ryan High-Voltage Laboratory, equipped with the world's largest transformer; the Food Research Institute; the Guggenheim Experimental Laboratory of Aeronautics, and the School of Medicine buildings in San Francisco, which include the Stanford University Hospital, the Clinical and Laboratory Building, Stanford School of Nursing, and the Lane Medical Library of 65,000 volumes. The productive funds in 1931 amounted to \$30,500,000. The number of students enrolled in 1931-32 was 3,532. The teaching staff of 563 members was headed by Dr. RAY LYMAN WILBUR.

STANLEY, ARTHUR PENRHYN (1815-81), English theologian and historian, was born at Alderley, Cheshire, England, Dec. 13, 1815. He was educated at Rugby, and at Balliol College, Oxford, where he continued as tutor for ten years. From 1851 to 1856 he was canon of Canterbury Cathedral, and from 1856 to 1863, was Regius professor of ecclesiastical history at Oxford. In 1862 he accompanied the Prince of Wales to Egypt and Palestine and on his return he was made dean of Westminster Abbey, a position he held until his death. Though a leader in the liberal movement in the Church of England, he held that it had always properly included men of High, Low and Broad church views. His best known writings are *Life and Correspondence of Thomas Arnold* (1844), and *History of the Jewish Church* (1863). He visited the United States in 1878. Stanley died in London July 18, 1881.

STANLEY, SIR HENRY MORTON (1841-1904), African explorer, whose real name was John Rowlands, was born near Denbigh, Wales, Jan. 28, 1841. When a boy he shipped as a cabin boy from Liverpool to New Orleans, where he was adopted and renamed by Henry Morton Stanley, a merchant. Stanley served as special correspondent for the New York Herald in Abyssinia and Spain from 1867 to 1869 and in 1869 was commissioned by the Herald to search for Livingstone. He started inland from Zanzibar, Mar. 21, 1871 and found Livingston at Ujiji on Lake Tanganyika, Nov. 10, 1871. During his four subsequent African expeditions he made many important geographical discoveries, as, the course of the Congo, the true size of Lake Tanganyika, the Mountains of the Moon, Lake Albert Edward Nyanza, and the great southwest gulf of Victoria Nyanza. He was an interesting writer, and was the author of *How I Found Livingstone, Through the Dark Continent*, and *In Darkest Africa*. He became a British subject and

was made a member of Parliament in 1895. Stanley died in London, May 10, 1904.

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STANNITE, a minor ORE of tin. It is steel gray to iron black, with a metallic appearance. In composition, stannite is a sulphide of copper, iron and tin, crystallizing in the TETRAGONAL SYSTEM. It is found in veins accompanying PYRITE, CASSITERITE and some silver minerals. Bolivia has the only tin deposits carrying much stannite, though it has been found in Cornwall, in Germany and in South Dakota. See also ORE DEPOSITS.

STANTON, EDWIN McMASTERS (1814-69), American public official, was born at Steubenville, O., Dec. 19, 1814. He attended Kenyon College 1831-33, later studied law, and was admitted to the bar in 1836. For a time he practiced in Cadiz, O., becoming in 1837 Prosecuting Attorney for the country. In 1856 he moved to Washington to practice before the United States Supreme Court. He was originally a Jackson democrat. Appointed Attorney General in 1860 in President Buchanan's cabinet, he took a firm stand for the Union and later vigorously opposed slavery. President Lincoln made him Secretary of War in 1862. In that position, his aggressive energy and impatient disapproval of many of Lincoln's acts often produced a tension which was eased only by the kindly understanding of Lincoln who fully appreciated the good judgment and administrative capacity of his stormy Secretary. After President Lincoln's assassination, he remained in President Johnson's cabinet, but in the breach between Johnson and Congress, Stanton supported Congress. He refused to resign and on Aug. 12, 1867, Johnson, during a recess of Congress, suspended him and appointed Grant, but Congress reinstated Stanton. President Grant appointed him Associate Justice of the Supreme Court in 1869, but he died four days later in Washington, Dec. 24, 1869.

STANTON, ELIZABETH CADY (1815-1902), American woman's rights leader, was born at Johnstown, N.Y., Nov. 12, 1815. In 1840 she married Henry B. Stanton, anti-slavery reformer. In 1848 she, with others, issued the call to the first woman's rights convention ever held in the United States, and in the same year was instrumental in procuring the passage of the married woman's property law in New York. First associated with Lucretia Mott, she worked after 1850 in close cooperation with Susan B. Anthony. Mrs. Stanton's demand for the enfranchisement of women formed the real foundation for the suffrage movement in the United States. She was president of the National Woman Suffrage Association, 1865-93. She died in New York City, Oct. 12, 1902.

STANZA, a typical group of lines from four to 16 in number, in a poem which is arranged in a fixed sequence in respect to its line length, meter and RHYME. The stanza developed as a further refinement after and through rhyme. The simplest are of

two lines rhyming together, as in some of the older ballads, and are of 4 lines with the rhyme scheme *abab* or *abba*. One of the oldest stanzas in English prosody, the OTTAVA RIMA, has eight lines, with the rhyme scheme *abababcc*; another well-known early form is the Spenserian, which consists of eight decasyllabic lines followed by an ALEXANDRINE, rhyming *abbabcbcc*. The RIME ROYAL—also known as the Troilus from its use in Chaucer's *Troilus and Criseyde*—is made up of seven iambic pentameter lines, with the rhyme *ababbcc*. See also POETRY; VERSE.

STAR APPLE (*Chrysophyllum Cainito*), a handsome evergreen tree of the sapodilla family native to tropical America and widely cultivated in warm regions for ornament and for its edible fruit. It grows about 50 ft. high bearing oblong leaves, covered below with silky, golden-brown wool, purplish-white flowers and smooth globose fruit, 2 to 4 in. in diameter, with a light green or purple skin and translucent white pulp. When cut across, the carpels containing the seeds present a starlike figure, hence the name.

STARA-ZAGORA, city and capital of a district in southern Bulgaria, situated on a slope of the Balkan Mountains in a fruitful, well-cultivated region. Grapes are cultivated and the manufactures include rough cloth, rugs and attar of roses. There are also a copper foundry, a tannery and popular mineral baths. Stara-Zagora is also an important railroad junction. After the almost complete destruction of the city by the Turks in 1878, it was rebuilt on a modern scale with streets intersecting at right angles. Pop. 1931, 29,417.

STAR CATALOGUES, lists of stars, usually arranged in order of right ascension, giving their brightness and position and sometimes other special properties, such as their motion or their spectral class. The oldest star catalogue, the ALMAGEST, dates from 137 A.D. Among the more important ones may be mentioned the Preliminary General Catalogue, giving the accurate positions and motions of some 6,000 stars; the Astrographic Catalogue, often called the Carte du Ciel, begun in 1887 by international cooperation and which when completed, will contain the accurate positions of three to four million stars; and the Henry Draper Catalogue, giving the spectral classes of 225,000 stars.

STARCH, is chemically defined as a high molecular weight, polysaccharide, which yields the sugars maltose and glucose on hydrolysis. Occurring in nearly all parts of plants, it is found most abundantly in the seeds and roots. The principal commercial sources of American starches are corn and potatoes, the quantity of corn starch produced being greatly in excess of the potato starches, which are made both from Irish and sweet potatoes. In Europe, potato starches have been manufactured in largest quantity, although the relative production of corn starch is increasing. Cassava, arrowroot and sago constitute the principal source of starches produced in the tropics.

The discrete packages of starch, termed granules, swell and rupture under the influence of hot water,

alkalies and such salts as thiocyanates and iodides. Treatment with acids and certain oxidizing agents can be so controlled as not to change the microscopic appearance of the granules but to modify the type of paste obtained when they are subsequently boiled with water. Starches so treated give a limpid paste on boiling whereas most untreated starches give a very thick and viscous paste. The terms "thin-boiling" and "thick-boiling" have been applied to these two types of starches. On incomplete hydrolysis or torrefaction, starch gives rise to various dextrans, which are more water soluble and less viscous in solution. The most characteristic reaction of starch is the intense blue coloration with iodine.

The manufacture of starch varies according to the source, but essentially the process involves the successive steps of soaking, grinding and washing. Approximately 1,000,000,000 lbs. are manufactured annually, most of which is used in textile sizing, paper finishing and glucose production. The manufacture of starch and its use as a size and finishing agent date back to antiquity, Pliny and Cato having described the processes. Modern uses of a less extensive nature include the manufacture of adhesives, nitrate explosives, and laundry stiffening compositions.

Starch has been the object of considerable scientific investigation because of its rôle as the reserve carbohydrate in all living plants and because it constitutes the principal dietary element of the human race. See also CARBOHYDRATES. R. P. W.

Starch as Food. The food value of all starches is very similar, making due allowance for the natural differences in their moisture content, which may range from 10 to over 20 per cent. In the diet, starch is one of the most important sources of energy, furnishing about 100 calories per ounce and constituting 50 to 70% of the solid matter of most cereals and about 80% of the solids of potatoes. It is also present in large amounts in many fruits and vegetables. The digestive juices convert it to glucose, in which form it is absorbed. While it is consumed principally in natural foods, it is also taken as such in starch puddings or as TAPIOCA or SAGO. When boiled with water, it is somewhat more digestible than in the raw state, because the individual microscopic granules of which it is composed swell and some varieties disintegrate.

C. L. A.

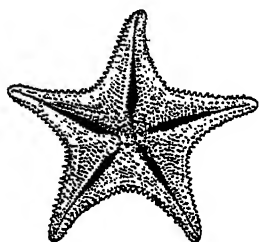
BIBLIOGRAPHY.—H. A. Auden, *Starch and Starch Products*; R. P. Walton, *A Comprehensive Survey of Starch Chemistry*; L. Eynon and J. H. Lane, *Starch: Its Chemistry, Technology and Uses*.

STAR CHAMBER, COURT OF, an extraordinary tribunal, deriving its name from the hall at Westminster in which it held its sessions. By an act of 1487, certain members of the Council were authorized to try specified cases, such as rioting and violation of the statutes of maintenance and livery, in connection with which the ordinary courts seemed unable to do justice. When the Long Parliament abolished the Court of Star Chamber in 1641 it assumed that the court owed its existence to that statute and had

exceeded its jurisdiction; its members were other than those specified in the act of 1487, so, too, were the cases which it heard. Constitutional historians to-day are agreed that the Court of Star Chamber did not date from 1487 nor derive its authority from an act of Parliament: it was the Council exercising its judicial functions through some of its members. A powerful agency for the maintenance of strong government under the Tudors, the court outlived its usefulness and threatened to become under the Stuarts an instrument of royal tyranny; and that was true reason and warrant for its dissolution.

STARCHING. See FINISHING.

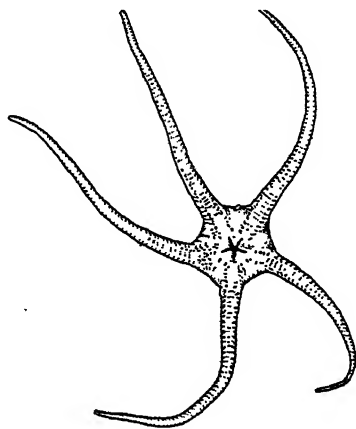
STARFISH, a general name for members of three classes of echinoderms which are shaped like stars.



STARFISH
(*Hippasteria pharygiana*). A
New England coast species

They include the sea stars (*Asteroidea*), the brittle stars (*Ophiuroidea*) and the feather stars (unstalked crinoids). As a rule the term starfish is used popularly for the sea stars, which, like the common American species (*Asterias vulgaris*), are familiar forms on every coast. Their arms or rays are continuous with their bodies, and their digestive and generative

organs extend into them. Most sea stars have five arms, but some have only four, and others have over thirty. Small tube feet or podia which usually have sucker discs at their tips, are ranged along the lower surface of the arms. If the sea stars are in danger they can



(*Diopederma axiologum*). A Lower California species

shed a ray and grow a new one in its place, and sometimes one ray can regrow all the others. Thus comet forms, having one large ray, and four smaller growing ones, are formed.

A sea star can walk only very slowly with his tube feet, but he can open an oyster with them by fixing

the suckers on different rays to the valves of the mollusk's shell, and pulling until the prey can no longer keep its shell closed. Then the sea star brings his stomach out through his mouth, which is on the under side of his body, and wraps it around the oyster. When the meal is digested he puts his stomach back again. In eating small things he passes his food to his mouth with his podia. The sexes are ordinarily separate, and the genital products are generally liberated in the water. Sea stars are important scavengers of the ocean, but they do great harm to oyster beds. Their bodies make good manure. See also BRITTLE STAR; FEATHER STAR; SUN STAR. A. I. W.

STARGARD, a German city in the Prussian province of Pomerania, about 20 mi. east of Stettin on the Ihna River. It became a city in 1253. Liqueur and brandy distilleries are located here. The city manufactures machines, shoes, felt goods, soap, cigars and other articles and has an active trade in grain, cattle and farm products. Pop. 1925, 32,545.

STARK, JOHANNES (1874-), German physicist, was born at Schichenhof, Bavaria, Apr. 15, 1874. In 1909 he became professor of mathematical physics at Aachen, in 1917 professor at Griefswald and in 1921 entered upon a career as an electrochemical expert. Stark investigated problems of electric charges in gases, discovering the STARK EFFECT, the splitting of spectral lines when the light is passed through an electric field, and the presence of the Doppler effect, the lengthening of vibration waves from a receding, and shortening from an approaching source, in electrical vibrations. He wrote *Electricity in Gases*, 1902, *Principles of Atomic Dynamics*, 1903, and *Structure and Spectrum of the Chemical Atom*, 1920. He received the Nobel Prize in physics in 1919.

STARK, JOHN (1728-1822), American Revolutionary general, was born at Londonderry, N.H., Aug. 28, 1728. He served in the French and Indian War, and at the outbreak of the Revolution he collected a regiment of mountaineers of which he became colonel. With these he fought at Bunker Hill, in the Canadian expedition, and in New Jersey under Washington. He resigned in April, 1777, but when Burgoyne threatened the region, he accepted command of a force of New Hampshire militia and with the "Green Mountain Boys" he defeated Burgoyne's forces near Bennington, Vt., Aug. 16, 1777. He was promoted to brigadier-general in the Continental army, took part in the warfare around Saratoga in 1777, and in 1778 and in 1781 commanded the Northern department of the army. He died at Manchester, N.H., May 8, 1822.

STARK EFFECT. In 1913, JOHANNES STARK discovered that the COLOR, i.e., the wave-length, of the LIGHT emitted from a gaseous discharge is slightly altered when the gas is subjected to a very strong ELECTRIC FIELD. This alteration is too small to be observed by the unaided eye but may be measured by means of a SPECTROSCOPE. Since light itself is not affected by an electrical field, it follows that the ATOMS and MOLECULES in the gas which is radiating

the light are influenced by external fields and, therefore, must be electrically charged.

The wave-length of the red line emitted by hydrogen gas (H_α of the Balmer series) is 0.000,065,63 cm. When an electrical field of 104,000 volts per cm. is used on the canal rays or in Crooke's dark space, this single spectral line is broken up into three components equally separated from each other by 0.000,000,028,8 cm. With stronger fields the separation is greater, and vice versa. The effect on the remaining spectral lines of the hydrogen atom is similar but more elaborate. For hydrogen, the resolution and the polarization of the lines (see POLARIZATION OF LIGHT) are distributed symmetrically on both sides of the original line. With other atoms, the distribution is, in general, unsymmetrical.

The QUANTUM THEORY has given a satisfactory mathematical treatment of the Stark Effect for hydrogen. J. B. H.

BIBLIOGRAPHY.—A. J. W. Sommerfeld, *Atomic Structure and Spectral Lines*, 1923.

STARLING, the common name for a family (*Sturnidae*) of passerine birds widely distributed in the Old World but most numerous in India and Africa. They are of medium size with usually black plumage often glossed with bronze or purple. In habit they are chiefly gregarious and move in very large flocks, living mostly upon the ground and feeding upon seeds, berries and insects. They nest generally in holes in trees or cliffs or about houses, laying blue eggs. The common starling (*Sturnus vulgaris*), which ranges practically throughout Europe, wintering southward as far as north Africa, is one of the best known of British birds coming in large numbers about parks and buildings. It is about $8\frac{1}{2}$ in. long and chiefly glossy greenish black, becoming browner and more spotted in winter. Because of its fine clear whistle and ability to mimic other birds and various human sounds, it is often kept as a cage bird. From 100 starlings liberated in 1890 and 1891 in Central Park, New York City, and a few subsequent importations have descended the countless thousands of these birds which have spread widely in the eastern states, more or less replacing the house sparrow and also driving away the bluebird.

STAR-OF-BETHLEHEM (*Ornithogalum umbellatum*), a small, stemless, bulbous perennial of the lily family frequently grown in gardens. It is a native of the Mediterranean region widely naturalized in the eastern United States. The plant produces narrow, somewhat grasslike root leaves between which rises a slender flower-stalk bearing several starlike flowers, green with white margins on the outside and white within, opening in full sunshine. The name is applied also to various other plants with star-shaped flowers.

STAR ROUTE FRAUDS, during the administrations of Presidents Grant and Hayes, malfeasance in the assignment of private contracts for the carrying of the mails. Such contracts bore three groups of stars, signifying celerity, certainty and security in

transportation. Thomas L. James, appointed Postmaster-General by President Garfield, uncovered the operations of Thomas W. Brady, in the Postmaster-General's department since Grant's administration, Senator S. W. Dorsey of Arkansas, and certain contractors, whereby compensation to contractors had been increased and the increase divided among the coterie. In "competitive" bidding the favored contractors had secured 134 routes at an aggregate compensation of \$143,169; supplementary agreements had increased the compensation to \$622,808. Brady, in retaliation for exposure, published correspondence revealing that in the course of his campaign for the presidency Garfield had extorted contributions from Government employees. Those implicated in the Star Route frauds were indicted. Political influence was manifest throughout the trials, and all the accused except one minor offender eventually escaped sentence.

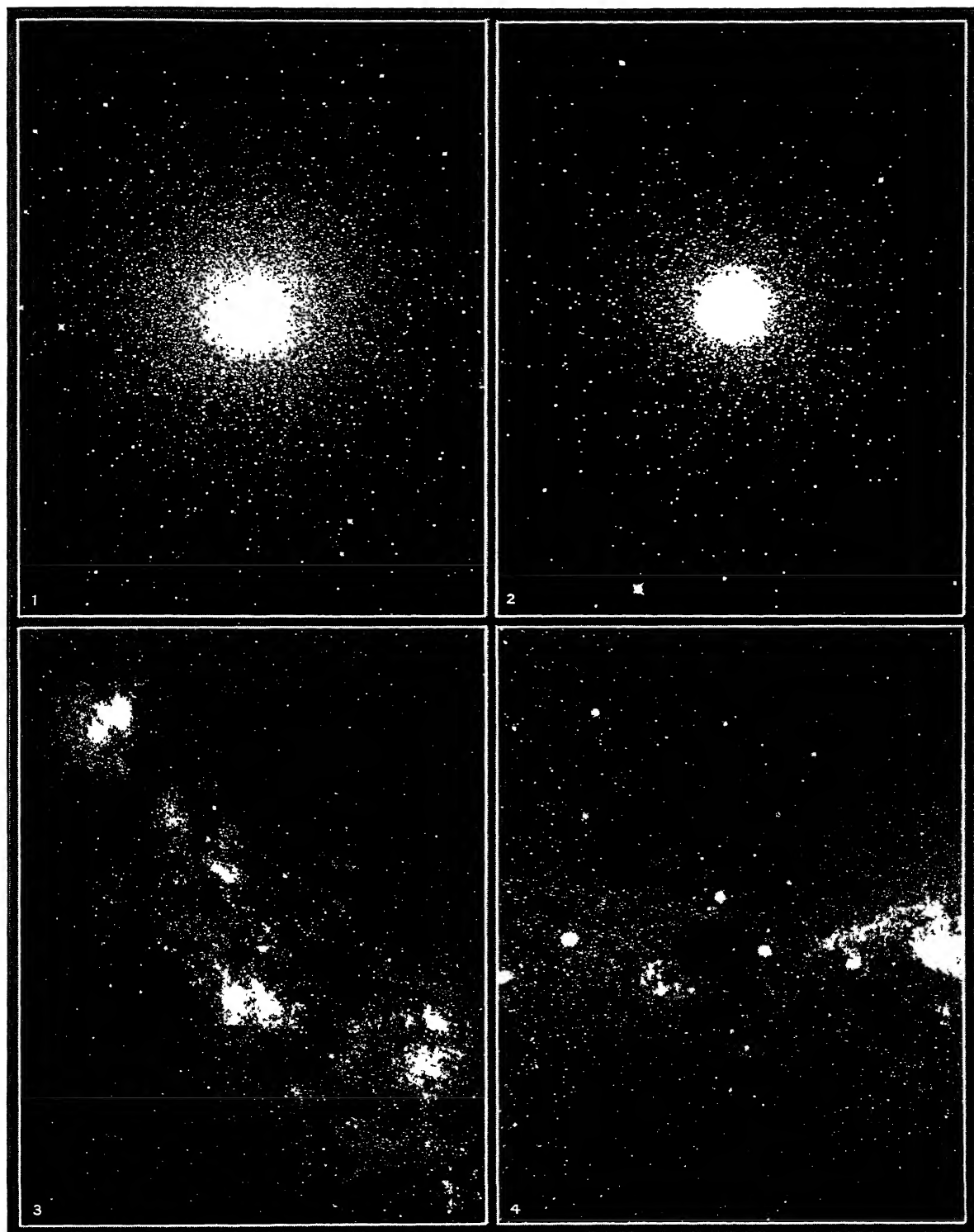
STARS, the heavenly bodies that appear to us as pin-points of light, shining in the sky at night, in reality self-luminous bodies like our sun, situated at vast distances from us. The first thing the unaided eye notices about them is their difference in brightness, and the rapid, steady increase in their numbers with decreasing brightness. Their brightnesses have been measured and expressed in magnitudes, the twenty or so brightest stars being of the first magnitude, while those just visible to the naked eye are assigned to the sixth magnitude. The unaided eye would be able to perceive altogether some 6,000 stars in the entire sky. A small field glass showing stars to the eighth magnitude brings out some 50,000, while a two-inch telescope would reveal more than a million. The 100-inch telescope at Mt. Wilson would record more than a billion stars brighter than the twenty-first magnitude.

The difference in apparent brightness of the stars, though partly due to a difference in distance, is in some measure also due to an inherent difference in intrinsic luminosity. The range of intrinsic luminosity is as great if not greater than that from the brightest star to the faintest visible, for some stars are known to exceed the sun 10,000 times or more in brightness while others give less than $1/10,000$ part of the sun's light. In space the stars actually fainter than the sun are by far the most numerous, comprising probably more than 90% of the total. But among those we see with the naked eye, stars fainter than the sun are the exception, numbering probably not more than a hundred or so in a total of 6,000.

A second characteristic which the eye notices in the stars is their difference in color, which ranges all the way from bluish white to yellow and red. As more detailed observations of the spectra of the stars indicate, this is due entirely to a difference in temperature. The blue stars are the hottest, ranging up to 35,000° F; the red stars the coolest, not more than about 3,000° F; the sun, with its 10,000° being again intermediate.

A comparison of the colors with the luminosities of

STARS



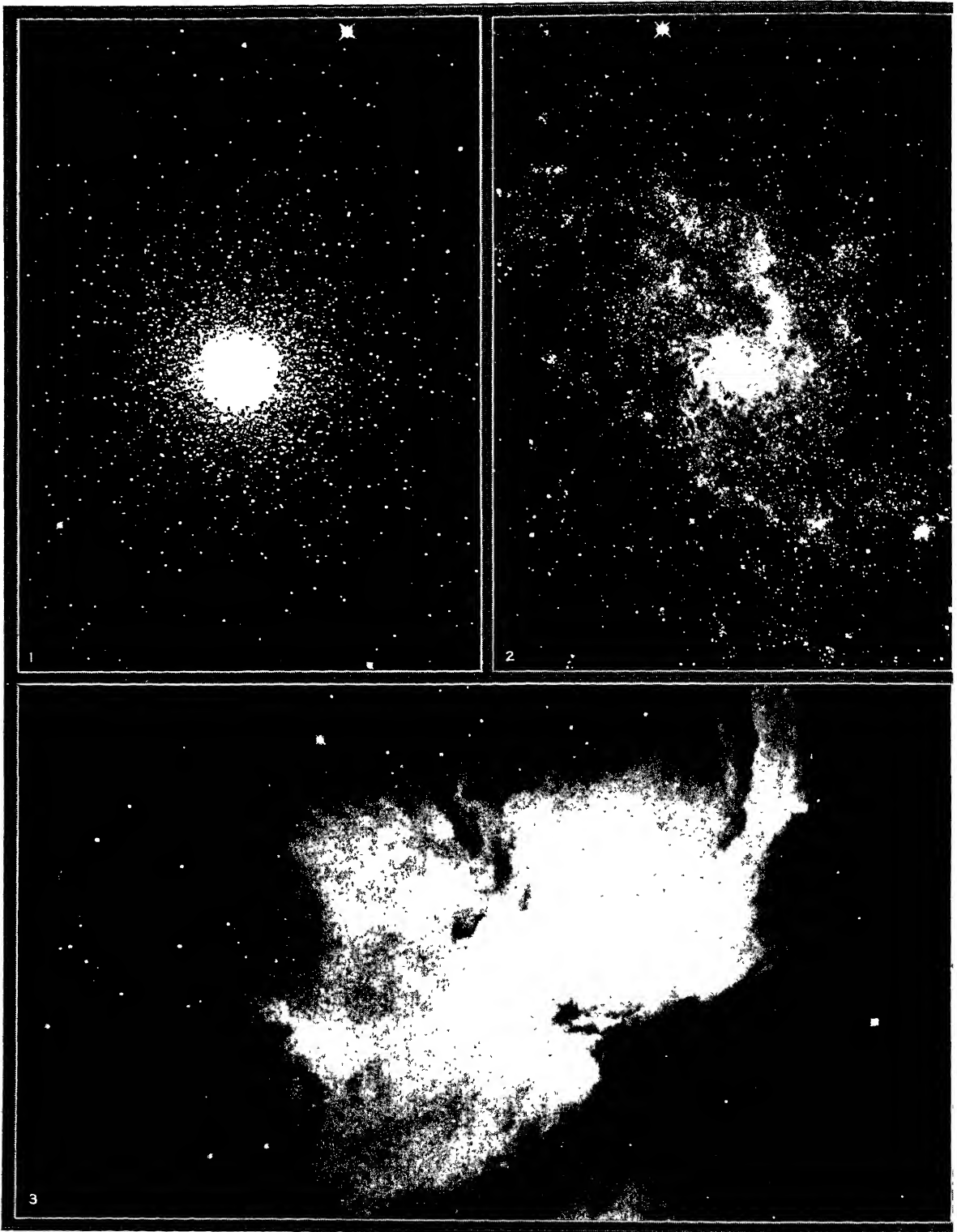
1, 2, 3, COURTESY MOUNT WILSON OBSERVATORY; 4, HARVARD COLLEGE OBSERVATORY

STAR CLUSTERS OF THE NORTHERN AND SOUTHERN HEMISPHERES

1. Globular star cluster Messier 13 in *Hercules*. 2. Globular cluster in *Canes Venatici*. 3. Star clouds in *Sagittarius*. 4. Photograph of the Southern Milky Way taken at the former Harvard Observatory Southern Station near Arequipa,

Peru. In the center is a dark nebula, the Coalsack. In the upper left is the great globular cluster *Omega Centauri*. Northwest of the Coalsack are the four stars of the *Southern Cross*, one of the brightest constellations of the southern skies.

STARS



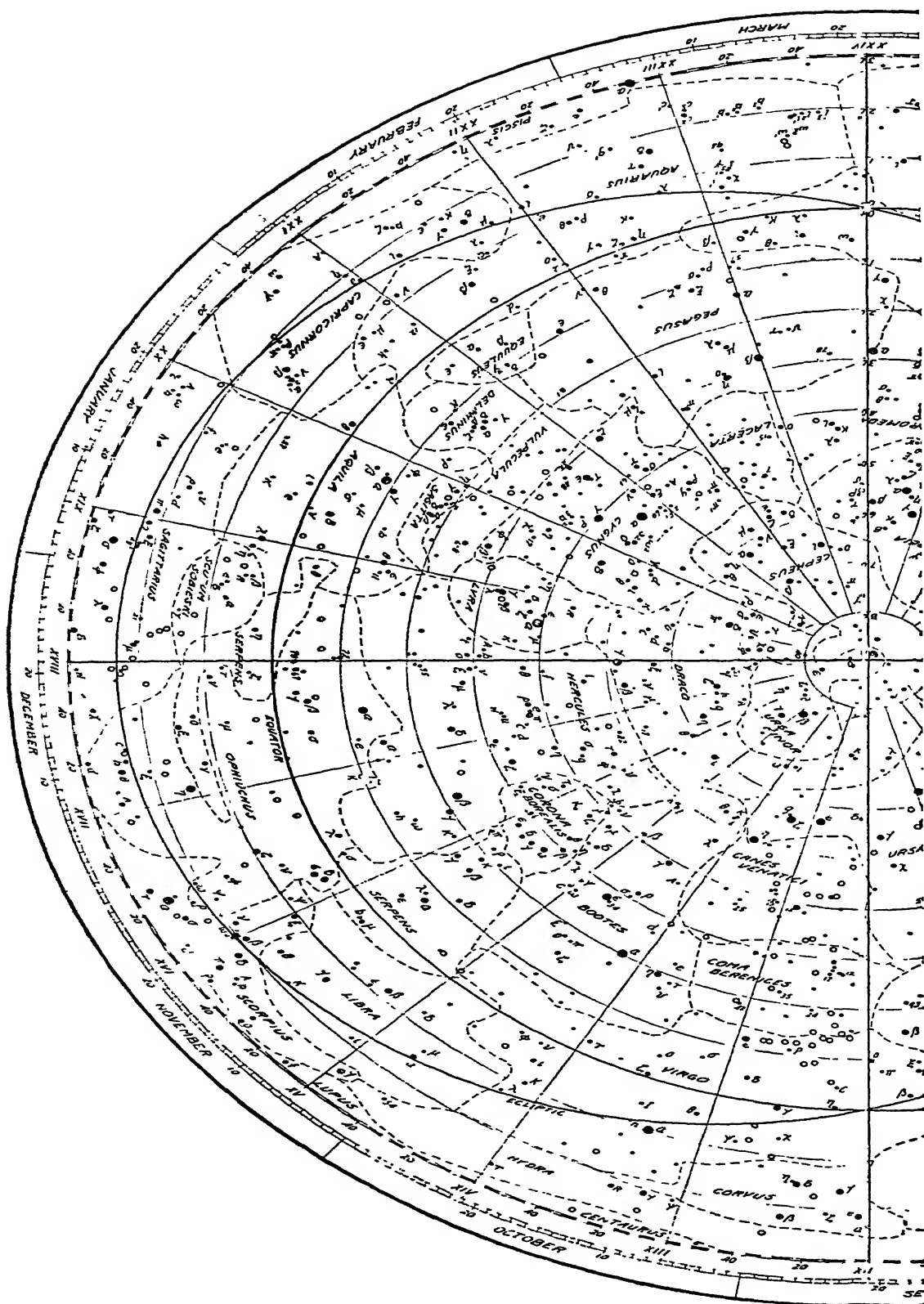
COURTESY MOUNT WILSON OBSERVATORY

NEBULAE AND STAR CLUSTERS

1. Messier 3, *Canum Venaticorum*, a globular star cluster.
2. Spiral nebula Messier 33 in the constellation *Triangulum*, one of the two largest extragalactic nebulae known. 3.

Great Nebula in *Orion*, a diffuse nebula so large that a beam of light would take 26 years to cross it. Its outer regions are spiral in character.

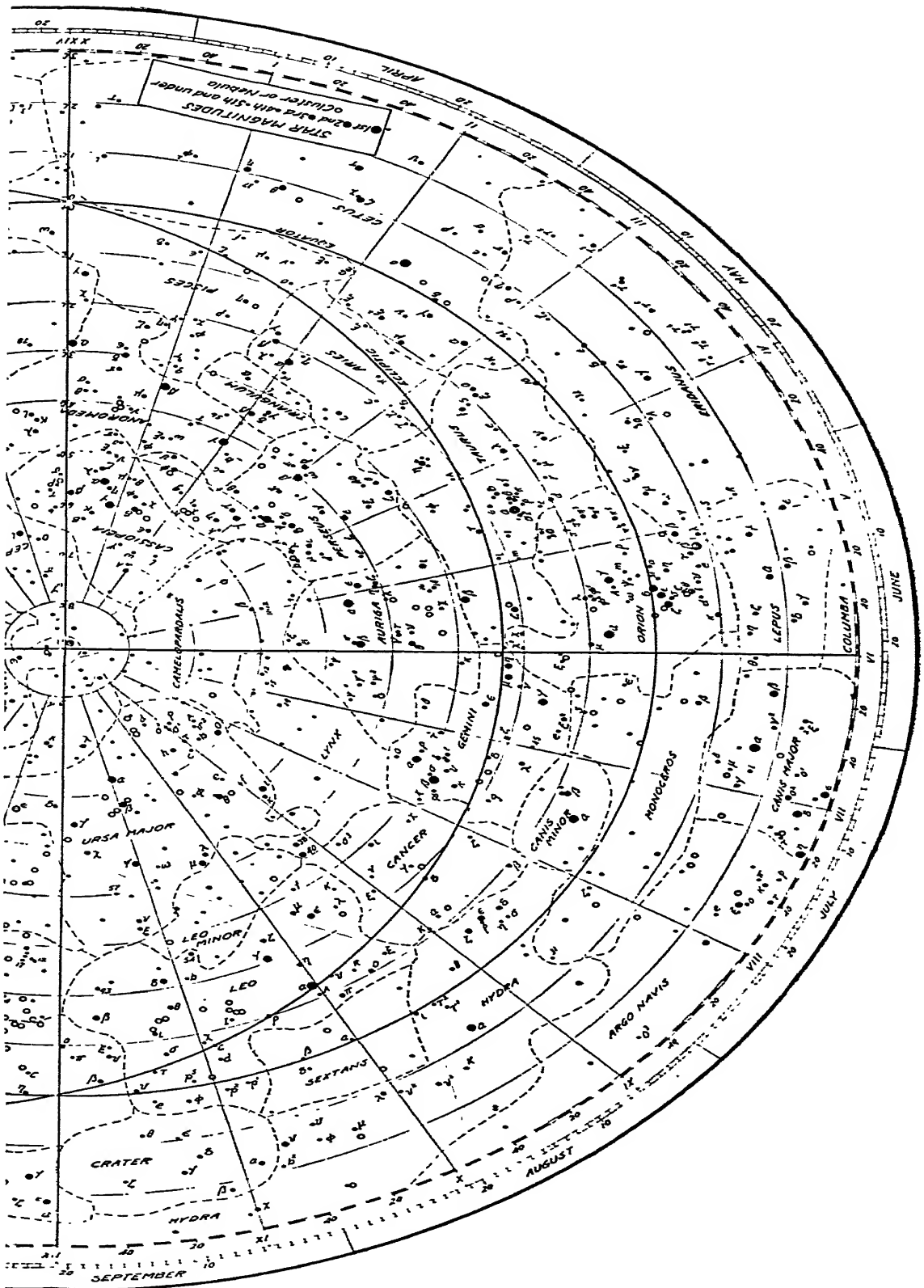
STARS



FROM KELVIN MC KREADY, A BEGINNER'S STAR-BOOK, G. P. PUTNAM'S SONS

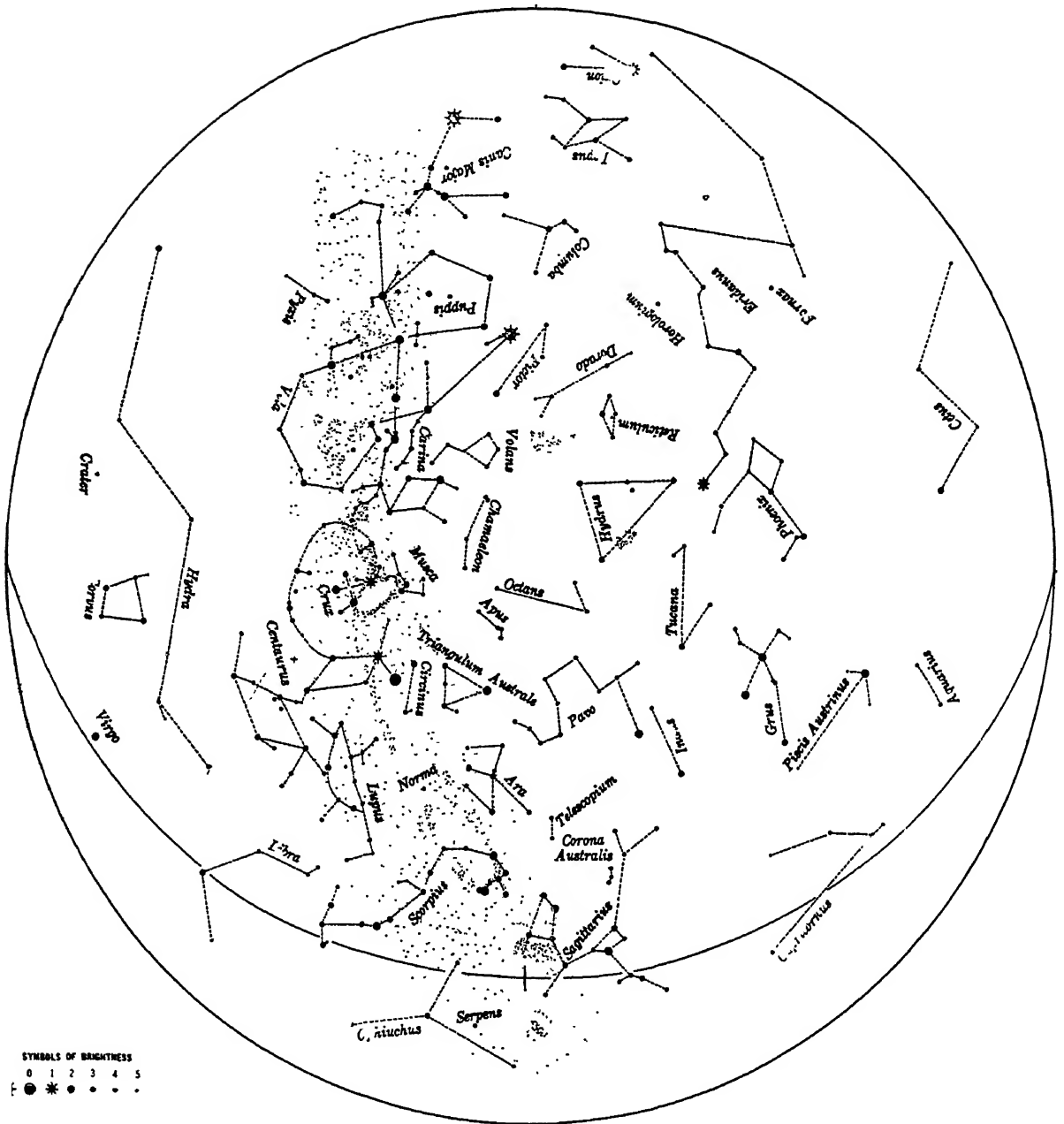
CONSTELLATIONS OF THE

STARS



NORTHERN HEMISPHERE

STARS



FROM SAMUEL G. BARTON AND WILLIAM H. BARTON, A GUIDE TO THE CONSTELLATIONS, MCGRAW-HILL BOOK CO.

CONSTELLATIONS OF THE SOUTHERN HEMISPHERE

The band of small dots indicates the Milky Way. Near the bottom of the chart is *Sagittarius*, often considered the center of the Milky Way system; the constellation contains some of the brightest stars of the heavens, great star clouds and globular star clusters. In the left center is the constellation *Crux*, of which the four principal stars outline the Southern Cross. Antares in the constellation *Scorpius* is the largest star known to astronomy; it is visible in the United States in July. The two Magellanic Clouds, patches of faint stars, nebulae and star clusters, also are features of the southern heavens. The larger cloud is found partly in the constellation *Mensa* and partly in the southern end of *Dorado*; *Tucana* contains the smaller cloud.

the stars has shown that the white stars are, with very few exceptions, all more or less of the same brilliance. But as the color becomes yellower and redder, two distinct classes of stars make their appearance, the giants and dwarfs. The giants have more or less the same luminosity for all colors, from 100 to 10,000 times that of the sun. The brightness of the dwarfs decreases as the color advances, from 10 times brighter than the sun to 100-10,000 times fainter than the sun for red dwarfs. Thus, among red stars, there may exist a disparity in luminosity of from 1 to 100,000,000 between giants and dwarfs. The red giants are giants not only in brightness but also in size. Their diameters may exceed that of the sun by as much as 500 times, while their density is more than 1,000 times less than that of our atmosphere. The white giants may be only a few times larger than the sun, and as dense as water; the red dwarfs several times smaller than the sun, and possibly 10 to 30 times as dense as water. A few very exceptional stars known as the **WHITE DWARFS** may be no larger than the earth but have a density 100,000 times that of water.

Compared to their size, the stars are very far apart. Direct observation of the **PARALLAXES** and hence of the distances of the stars has shown that they are, on the average, some 5 to 10 light years apart. The nearest star, **PROXIMA CENTAURI**, is 4.2 light years distant from the sun. If the sun were represented in size by the period at the end of this sentence, this nearest of all stars, likewise represented by a period, would have to be 5 miles away. Careful observation has shown that there are many **DOUBLE STARS** and **VARIABLE STARS** in the sky, the former consisting of two stars appearing very close together, the latter being subject to fluctuations in brightness.

A comparison of the precise positions of the stars obtained over long periods of time has revealed that the stars are not really fixed, but are moving in space. The only reason that these **PROPER MOTIONS** of the stars, as they are called, are not more apparent is that the stars are so remote that their angular displacements in the sky appear minute and can only be determined from very accurate observations. In addition to these proper motions, the stars have velocities in the line of sight toward us, or away from us; these **RADIAL VELOCITIES** may be measured with the spectroscope.

The motions of the stars in space appear chaotic at first sight, but statistical analysis soon reveals that a part of their apparent velocities is merely a reflex of the motion of the sun which is directed toward a point near Vega, with a speed of 13 miles per second. After the effect of this **SOLAR MOTION** is allowed for, it again appears that there exists a general tendency among the stars to move parallel to a certain direction in space, either one way or the opposite, rather than across it; these two directions are called the directions of star-streaming. After this second effect is allowed for, it appears that the velocities of the stars in space are very nearly at random, resembling somewhat those of the molecules of a gas; their speeds average about

20 miles per second, though some range as high as 400.

Sometimes it is found that two stars quite a distance apart are moving exactly parallel in space; they are physically connected. Whenever a large number of stars are found to move parallel in space, they are referred to as a **MOVING CLUSTER**. If such a group of physically connected stars is situated at a great distance from us, they appear as a conglomeration of stars, and their connection is at once obvious through their mutual proximity; it is then an ordinary star cluster, a good example of which may be found in the **Pleiades**.

Still different are the globular clusters, containing a great many more stars than the average clusters, and, at their great distance, appearing all very closely packed together. The globular clusters stand in close relationship to the **MILKY WAY**, that great aggregation of stars and star clouds that forms the backbone of our stellar system. W. J. L.

STARS, COLOR OF. This may be easily observed even with the naked eye and is due to a difference in temperature. Red stars such as Betelgeuse and Antares give evidence of their comparative coolness, while white and blue stars such as Rigel and Achernar have very high temperatures. Formerly direct estimates were made visually, but in modern times a more refined method has been introduced by means of photography. As an ordinary photographic plate is more sensitive to blue light than to yellow and red light, it follows that of two stars one blue, one red, which appear equally bright to the human eye, the blue one will appear much brighter on the photographic plate.

Accurate visual **MAGNITUDES** of thousands of stars have been determined by means of a visual photometer. Similarly, photographic magnitudes have been adjusted to give the same values for white stars, such as Sirius, and Vega. The difference still existing between the values for any individual star then gives a measure of the star's color, and is called color-index. It is taken in the sense photographic minus visual, and hence is positive for yellow and red stars and negative for blue stars. More recently, so-called photovisual magnitudes have been secured by photographing through a yellow filter on an isochromatic plate. They are practically identical with visual magnitudes, and are nearly as accurate. W. J. L.

STAR-SPANGLED BANNER, a composition of words and music which was made the national anthem of the United States of America on Mar. 3, 1931, by an Act of Congress, approved by the President. It was written by **FRANCIS SCOTT KEY**.

Whenever the national anthem is played on board a vessel of the Navy, at a Naval Station, or at any place where persons belonging to the Naval Service are present, all officers and enlisted men not in formation shall stand at attention facing toward the music, except at Colors, when they face toward the Colors. If in uniform, covered, they shall salute at the first note of the anthem, retaining the position of salute

until the last note of the anthem. If not in uniform, and covered, they shall uncover at the first note of the anthem, hold the head dress opposite the left shoulder, and so remain until the last note of the anthem, except that in inclement weather the head dress may be slightly raised. The Army has similar regulations. In civilian gatherings it is customary to display respect by standing and removing the head dress.

R. E. C.

STAR THISTLE, the name given to spiny species of *Centaurea*, annual herbs of the composite family, native to Europe and Asia and widespread in many regions as weeds. The purple star thistle (*C. Calcitrapa*) grows about a foot high with much divided



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

YELLOW STAR THISTLE

Achene and pappus, flowering branchlet and flower

spinulose leaves and purple flowers in sessile heads, an inch broad, surrounded by stout, spreading, yellowish, very sharp spines. The similar yellow star thistle or Barnaby's thistle (*C. solstitialis*), with bright yellow flowers, has become a pestiferous weed in California.

STARVED ROCK, a fortress-like and almost inaccessible rock of white sandstone, on the south bank of the Illinois River between the cities of Ottawa and La Salle in La Salle Co., Illinois, 98 miles southwest of Chicago. The walls rise sheer to a height of 160 ft., overhanging the river and sloping dangerously and abruptly on all sides. A narrow rocky stairway is the sole means of access to the top of the rock. The summit, which is flat and about a half acre in area, commands a superb view of the Illinois River Valley with its fertile farmlands and wooded hills. In 1673 Father Marquette and Joliet visited Kaskaskia, the chief village of the Illinois Indians which was situated in a valley near the rock. Eight years later La Salle and Tonti built Fort St. Louis which proved an important strategic point during the early days of French occupation of the Mississippi Valley.

The name, Starved Rock, dates from 1770. A warrior of the Illini killed Pontiac, the famous chief of the Ottawas at a council meeting at Cahokia. To avenge the murder the Ottawas swore to annihilate

the Illini. War followed and the last of the Illini were finally trapped on the top of this rock and there died of starvation. Starved Rock and immediately adjacent points of historical interest have been made into a state park. The area comprises 813 acres of picturesque scenery with cliffs, gulches and canyons carved out of sandstone and limestone.

STATE, a term used to denote a community of individuals independent of foreign or external control, permanently occupying a given territory, possessing an organized government to which the great body of inhabitants render habitual obedience. Popularly the term is used interchangeably with NATION and GOVERNMENT. Technically, however, the meaning is quite distinct. By definition the state is a sovereign society organized for a political purpose. The government is merely the agency through which the state functions, composed very frequently of executive, legislative and judicial branches. The overwhelming majority of individuals in the modern era are members of the state; only a small minority, however, are officers of the government. A distinction must similarly be made between state and nation. The simple fact is a state may or may not be synonymous with a nation. It may, on the other hand, embrace within its jurisdiction several nations or nationalities, or it may fail to include a single one. Thus within the British Empire are the Celts of Ireland and the Dutch of South Africa; in the CANTONS of Switzerland are French, Germans and Italians.

The origin of the state remains wrapped in mystery. A number of theories have been developed, chief among these are the theory of divine origin, the compact theory, the patriarchal and matriarchal theories, the theory of force, and finally the theory of historical evolution. The latter is, perhaps, the most generally accepted theory to-day.

S. C. W.

BIBLIOGRAPHY.—J. W. Garner, *Introduction to Political Science*, 1910.

STATE, DEPARTMENT OF, a governmental department headed by the Secretary of State, first in rank among members of the CABINET and the link between the President and the governors of the states. The department has charge of negotiations of whatever character in the foreign affairs of the United States. Communications with foreign governments, executive proclamations, extradition warrants and passports are issued by the office of the State Department. It also publishes laws and resolutions of Congress and amendments to the Constitution. An Under-Secretary of State and Assistant Secretaries are the principle officers aiding the department head. A Solicitor handles claims arising under international law and treaties. The Foreign Service School and Personnel Board prepare members of the Foreign Service and recommend assignments and promotions. The Division of Foreign Service Administration performs the detail work in regard to expenditures and executes international agreements of a routine nature, such as customs courtesies (see CUSTOMS DUTIES). Separate divisions have general charge of affairs in vari-

ous sectors of the world. Another division is charged with arrangements for international conferences and official functions. The Treaty Division assists in the drafting and termination of TREATIES and pertinent laws. There are additional bureaus for custody of the archives, accounts, translation, coordination and review.

S. C. W.

BIBLIOGRAPHY.—*Report of the Department of State, 1931; Congressional Directory, 1931.*

STATE COLLEGE, a borough in Center Co., central Pennsylvania. It is situated 34 mi. northeast of Altoona and is served by bus lines and the Bellefonte Central railroad. The borough is the seat of PENNSYLVANIA STATE COLLEGE, founded in 1855 and having about 4,500 students enrolled. Farming is the leading interest of the vicinity. Pop. 1920, 2,405; 1930, 4,450.

STATE FLOWERS. The movement for the selection of official state flowers has been developing in the United States for some forty years and in 1932 Pennsylvania completed the list so that all of the 51 political divisions each have a flower. These have been in some cases officially chosen by the state legislatures, in others by popular vote of school children or in other ways. State flowers are mostly common ornamental native plants, but in a few cases cultivated plants have been chosen.

Alabama, goldenrod.	Montana, bitterroot.
Alaska, forget-me-not.	Nebraska, goldenrod.
Arizona, giant cactus.	Nevada, sagebrush.
Arkansas, apple.	New Hampshire, lilac.
California, California poppy.	New Jersey, violet.
Colorado, columbine.	New Mexico, yucca.
Connecticut, mountain laurel.	New York, rose.
Delaware, peach.	North Carolina, daisy.
District of Columbia, American beauty rose.	North Dakota, wild prairie rose.
Florida, orange.	Ohio, scarlet carnation.
Georgia, Cherokee rose.	Oklahoma, mistletoe.
Hawaii, lehua (<i>Metrosideros</i>).	Oregon, Oregon grape.
Idaho, syringa.	Pennsylvania, daisy.
Illinois, violet.	Rhode Island, violet.
Indiana, tulip tree.	South Carolina, yellow jessamine.
Iowa, wild rose.	South Dakota, pasque flower.
Kansas, sunflower.	Tennessee, passion flower.
Kentucky, goldenrod.	Texas, bluebonnet.
Louisiana, magnolia.	Utah, sego lily (<i>Calochortus</i>).
Maine, pine cone and tassel.	Vermont, red clover.
Maryland, black-eyed Susan.	Virginia, dogwood.
Massachusetts, trailing arbutus.	Washington, rhododendron.
Michigan, apple.	West Virginia, rhododendron.
Minnesota, showy moccasin-flower.	Wisconsin, birdfoot violet.
Mississippi, magnolia.	Wyoming, Indian paint-brush.
Missouri, red haw (<i>Crataegus</i>).	

H. A. G.

STATE FORESTS, areas set aside by legislative enactment for forest conservation. They have been established in 30 states and cover a total area of nearly 8,000,000 acres (1931). The first preserve was established in 1885 when the New York legislature created a state forest commission with custody of 800,000 acres in the Adirondack Mountains, known as the Adirondack State Forest. A large tract was similarly set aside in 1899 in the Catskill Mountains.

These regions, greatly enlarged, were subsequently designated as state parks.

Administration. State forest administration is variously in the hands of a division of forestry under a department of conservation, a state forestry commission or a state forester. State forests have greater uniformity of administration than state parks, probably due to the fact that their establishment has been prompted by the primarily economic purpose of forest preservation. State activities in experimentation and reforestation are frequently centered in the state forests. Forty-one states and two territories have a state forester or similar officer.

Acquisition. Several methods have led to the acquisition of state forests. Chief of these is purchase as a result of legislative appropriation. Occasionally they have been given to the state and in some instances, as in New York and Pennsylvania, purchase has been made possible by a bond issue. In the West a number of state forests have been created through the exchange of school land grants for equivalent areas in the national forests. In Washington, Michigan, Wisconsin and Minnesota large forest units are being built up out of tax-title lands.

Recreational Use. The large area of the average state forest provides ample opportunity for recreational activities such as camping, hiking, hunting and fishing and has made them a great public playground. They are a favorite location for the camp sites of Boy Scouts and Girl Scouts, Y.M.C.A., Y.W.C.A., and other church and fraternal organizations. New York with over two million acres in state forests has the largest acreage of any state in the Union. Pennsylvania follows closely and has established 46 public camps. Each camp site is near a spring, a mountain stream or a well and has fireplaces, tables, benches, comfort stations and garbage containers. A permit for camping privileges is obtainable from the office of the district forester. An extensive reforestation program in Pennsylvania has its center in the state forests. The state of Washington reports a total of 1,012,289 acres in state forests (1931). New Hampshire with 57 state forests has the greatest number. Its forests, however, are not extensively developed for recreation. Chiefly the larger forests, Franconia Notch, Crawford Notch, Cardigan Mountain, and Pillsbury, have been developed for public camping, being virtually of state park character, and many of the smaller ones have neither roads nor trails. The 44 state forests in Massachusetts vary in size from a few acres to the great October Mountain Forest of 13,652 acres in the Berkshire Hills. Most of them have roads, trails and camp sites and are extensively used by the public. Three unusually large state forests, Pillsbury, Burntside and New State Forest, have been set aside in Minnesota from state lands and U.S. land grants. Burntside and New State contain public campsites accommodating several hundred people.

STATE MONUMENTS, points or places of historic, prehistoric or scientific interest which the citizens of the various states have deemed worthy of preser-

vation. In some instances the land has merely been set aside, in others a monument commemorating the event and the person or persons connected with it has been erected.

In 1931 there were 136 state monuments distributed in 17 states. New York with 27 has the largest number of state monuments. The great majority commemorate sites of battles of the French and Indian War and the War of the Revolution or are otherwise connected with colonial history. "Yankee Doodle" is said to have been composed at Fort Cralo in Rensselaer which is now preserved as a monument. North Dakota has 25 state monuments, the second largest number. They include Pembina, the first trading-post in the state, camps and battlefields of the Sibley Expedition of 1863 against the Sioux Indians and sites of several early Indian villages. California's eight monuments include Marshall's Monument erected in Eldorado County in honor of the discoverer of gold in the state and a statue marking the landing place of Father Serra, the founder of the California Missions, at Monterey. Various phases of the life of Abraham Lincoln are commemorated by five monuments in Illinois, among them his boyhood home which has been acquired by the state and is being restored, the Lincoln Homestead in Springfield, a Lincoln Memorial Museum in the Metamora Court House and the Lincoln Monument and Memorial Hall in Oak Ridge Cemetery, Springfield. Kentucky has preserved the John Rowan homestead as a state monument and calls it "My Old Kentucky Home." It was this homestead which inspired Stephen Collins to write his famous song by that name and is also the place where he wrote "Massa's in the Cold, Cold Ground," "Old Black Joe," and some 170 other songs.

Ohio's 19 historical and archeological parks are classed as state monuments and include five remarkable examples of the work of the prehistoric mound builders. Serpent Mound in Adams County has been pronounced the greatest effigy earthwork on the North American continent if not in the world. Another prehistoric mound is preserved as a state monument in Marshall County, West Virginia, the land having been purchased by the school children of the state.

STATEN ISLAND, a three-cornered island situated about 5 mi. southwest of the extremity of Manhattan Island, and surrounded by Arthur Kill and Kill van Kull on the west and north, the Narrows on the east, and by Lower New York and Raritan bays on the southeast. The area is approximately 57 sq. mi. Its surface is moderately hilly, rising to nearly 400 ft. at Grimes Hill. Forts Tompkins and Wadsworth, on the Narrows side of the island, defend the entrance to New York City. Staten Island is dotted with industrial communities and residential villages, including New Brighton, Port Richmond, Tottenville, St. George, New Dorp, Stapleton and Tompkinsville.

STATE PARKS, in general, regions under state control which have been set aside to provide public recreation in its widest sense. They may be said,

in most cases, to include the exceptionally scenic areas of the several states which have established them; many areas primarily of historic or scientific importance have also been designated as state parks, though the tendency is to classify such holdings as state monuments. There is a wide variation in the standards which the various states have established or accepted, under which areas are given state park status.

The first regions which legitimately can be called parks were the "great ponds" set aside in the Massachusetts Bay Colony in 1641 for the perpetual use of the public for "fishing and fowling," occupations which were then a necessity and not primarily a recreation as they are to-day. It is only during the 20th century that the idea of establishing state park systems has become clear and definite; parks established during the preceding 40 years were largely the result of efforts to save certain scattered areas menaced with destruction. The greatest development of the idea has come since 1920.

The national conference on state parks reports a total state park acreage of 2,962,912 acres in 33 states in 1931. In total number of parks, Michigan with 71 covering 45,884 acres heads the list; New York with 61 parks is second in number but the total area of New York's parks, 2,346,809 acres constitutes 79.2% of the state park area of the entire country.

By act of Congress the Yosemite Valley and the Mariposa Grove of big trees were given to the state of California in 1865 for recreational purposes, constituting the first state park to be established. Actual control of the area and its development was delayed for ten years by claims of settlers and it was subsequently returned to the federal government in 1905 to become part of the Yosemite National Park. Efforts to preserve Niagara Falls from exploitation and defacement were begun in 1867 and resulted in the establishment in 1885 of the Niagara State Reservation, New York's first state park originally including Goat Island and adjacent islets, Prospect Park on the brink of the American Falls and a narrow strip of land along the upper rapids. Also during 1885 Mackinac Island, which has been a National Military Reservation and a National Military park, was transferred to the state of Michigan. Minnesota was next to enter the field, establishing in 1889 the Birch Coulee Park, a battleground of the Sioux War, and in 1891 the beginnings of Itasca State Park.

Acquisition. State parks have been acquired through gifts, proceeds of bond issues, transfer of federal lands, tax levies, exchange of school lands, purchase through legislative appropriation and the use of fish and game funds. Of Michigan's 71 parks, 60 were donated, the Dodge Brothers alone having donated ten areas, chiefly in the vicinity of Detroit. Probably the largest gifts have been in New York where several millions were donated for the Palisades Interstate Park in addition to valuable gifts for parks in other sections of the state. Gifts have been a factor of primary importance in establishing the park systems of Indiana, Iowa, Kentucky, Minnesota, Texas,

STATE FLOWERS



PAINTED FOR THE NATIONAL ENCYCLOPEDIA BY MARY E. EATON

STATE FLOWERS OF THE WESTERN HALF OF THE UNITED STATES

1. Blue Violet (*Viola cucullata*), Illinois. The Blue Violet also is the flower of New Jersey and Rhode Island and the Bird's-Foot Violet of Wisconsin. 2. Blue Columbine

(*Aquilegia caerulea*), Colorado state flower. 3. California Poppy (*Eschscholzia californica*), California state flower. 4. Oregon Grape (*Mahonia (Berberis) Aquifolium*), Oregon.

STATE FLOWERS



PAINTED FOR THE NATIONAL ENCYCLOPEDIA BY MARY E. EATON

STATE FLOWERS OF THE EASTERN HALF OF THE UNITED STATES

1. Great Laurel (*Rhododendron maximum*), West Virginia state flower. 2. Black-Eyed Susan (*Rudbeckia hirta*), Maryland state flower. 3. Evergreen Magnolia (*Magnolia gran-*

diflora), Louisiana and Mississippi state flower. 4. Wild Rose (*Rosa palustris*), Iowa and New York state flower. The Cherokee Rose is the state flower of Georgia.

Washington and Wisconsin. Bond issues are the second means of acquiring funds for state park purposes.

Administration. Great variety exists in the types of agencies administering state parks, among them commissions and superintendents controlling single parks or entire systems, state foresters, highway commissions, fish and game commissions, historical and scenic societies, private organizations holding lands as public trusts and departments of agriculture. After study of administration in states, the National Conference on State Parks published in 1922 a model park law and since that time the tendency has been to centralize all recreational, developmental, and conservation activities within a state in one department or commission thus permitting coordinated and efficient administration and resulting in mutual benefits. A number of states including California, Indiana, Louisiana, Massachusetts, Michigan, Minnesota, New York, North Carolina, Virginia and Wisconsin, have such departments controlling forest, fish and game and other comparable activities as well as parks. Indiana has adopted a policy of charging a small fee, 10 cents, for admission to each of its parks thereby distributing operation costs among users and largely relieving the taxpayer of the burden of support.

Types and Facilities. State parks vary in size from historical sites of a fraction of an acre to the tremendous Adirondack State Park in New York with an area of 2,009,943 (1931) acres. The great increase in number of state parks since 1920 is due primarily to the advent of the automobile and consequent growth of cross country travel and to the increased population of cities making easily accessible outdoor recreation areas a necessity. Many state parks offer opportunities for camping, hiking, boating, fishing and other recreations. Some have shelters in the form of wooden shacks or canvas tents which may be rented by the night or for longer periods. This system originated on the Pacific coast and is spreading eastward. In the northern states the parks are increasingly used for winter sports; Palisades Interstate, Allegany, and Cook County Forest Preserve in particular having special developments for skating, skiing, and tobogganing. Several of the largest have hotels operated directly by the state or under concession, Indiana being the lead in this type of development. The most extensively developed state park in the country is the Palisades Interstate Park in New York where the facilities, in addition to those previously mentioned, include excursion steamboats, sight-seeing buses, and swimming pools.

STATE RIGHTS, a term frequently used to denote those governmental powers retained by the local or state units in a federal system of government. Article X of the Amendments to the Constitution of the United States specifically provides that "the powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States or to the people." The intensity with which the principle of state rights is a maxim of popular political faith varies from country to country;

it is usually strongest in federal unions composed of originally independent states. Disputes over the proper interpretation of the grants of power to the federal government set forth in the constitution of the state are almost inevitable. And if, cloaked behind the verbiage and rhetoric of the dispute over the language of the constitution, there is a clash of fundamental interests, civil war may be the outcome, "state rights" the slogan of the weaker party. Such was the history of state rights in the United States. At first the battle cry of the New England Federalists, it was later to become the political shibboleth of the South, with which section it is to this day strongly associated. Much more fundamental than the disputations of the constitutional lawyers in producing the armed conflict of 1860-1865 was the clash of economic and moral forces. It is interesting to note that even in the 20th century the issue is occasionally at least raised anew in connection with both taxation and prohibition.

S. C. W.

STATES-GENERAL, the name used to describe the assemblies, representative of the various estates of the realm in France, in the days before the Revolution, occasionally called together by the monarch for advice and council. The States-General had no right of legislation; actually at one period of its history it exerted very considerable influence through its right to petition and request. No meetings of the States-General were held in France between 1614 and 1789, and it was summoned for the last time in 1789, when it eventually became by revolutionary action the National Constituent Assembly.

STATESVILLE, a city and county seat of Iredell Co. in west central North Carolina, situated on the Catawba River, 43 mi. north of Charlotte. An airport, bus lines and the Southern Railroad serve the city. Live stock, cotton, grain and fruit are raised in the vicinity. Statesville is a farm trading market and an important industrial center with more than 65 factories, manufacturing principally cotton, tobacco, and wood-working products. In 1929 the value of the factory output was about \$10,000,000; the retail trade amounted to \$5,280,994. The city was founded in 1750 and incorporated in 1789. Statesville was the capital of North Carolina during the Confederacy, after the fall of Raleigh. It is the birthplace of KIT CARSON, the frontiersman. Pop. 1920, 7,895; 1930, 10,490.

STATIC, the name applied to natural sources of radio INTERFERENCE as distinguished from man-made sources. The name is also often applied to the interference itself. Electromagnetic radiations, such as those accompanying lightning, result in shock excitation of the tuned circuits in a RADIO RECEIVER, producing interfering sounds superimposed on the desired signals. *See also* ATMOSPHERICS.

STATICS. *See* MECHANICS.

STATION, RAILROAD. *See* RAILROAD BUILDINGS.

STATISTICS, a plural noun referring to the quantitative factual information on any subject, e.g., the

POPULATION statistics of the United States. Used as a singular noun, statistics refers to the generally accepted body of principles and methods that are employed in the analysis and presentation of quantitative data.

The methods and principles of statistics may be treated under six general heads: time series analysis, frequency distribution analysis, index number construction, correlation, probability and sampling and graphic presentation.

Time Series Analysis. A time series is an historical record, taken at regular time intervals, of some phenomenon. Economic time series usually exhibit the influence of four different kinds of forces. 1. SECULAR TREND, 2. SEASONAL VARIATION, 3. Cyclical variation, 4. Accidental or random variation. The actual observations are assumed to be the product of the four forces. The procedure of analyzing a time series is, in general, as follows. First, the trend is determined, usually by the method of LEAST SQUARES for each month of the period covered. Then the actual values are divided by corresponding trend values, for

if Actual = Trend x Seasonal x Cyclical x Random

then $\frac{\text{Actual}}{\text{Trend}} = \text{Seasonal} \times \text{Cyclical} \times \text{Random}$

Second, the typical seasonal influence is determined. (See SEASONAL VARIATION.) This force is removed by dividing it out of the percentage ratios of actual to trend, thus:

$\frac{\text{Actual}}{\text{Trend}} \div \text{Seasonal} = \text{Cyclical} \times \text{Random}$

Usually the analysis is left at this stage. However, in some instances a three, five, or seven months' moving average is run through the cycle-random relatives to approximate the effect of the smooth cyclical force.

Time series analyses enable the statistician to forecast more intelligently the future movements of a time series. For example, if the analysis had shown that the trend value for pig iron production for the next month were 4,000,000 tons, if the seasonal index were 110% and the cyclical factor 70%, not accounting for accidental factors or random would be 4,000,000 x 1.10 x 70 or 3.08 million tons.

Frequency Distribution Analysis. The time series shows changes over a period of time. The frequency distribution shows the various aspects of a given phenomenon at a given moment of time. The analysis is based upon the frequency table in which the various items are classified according to the measurements of the characteristic in which the interest lies. Thus, for example, the sales of women's shoes may be classified according to the frequency with which various sizes are purchased.

Interest centers in three distinct characteristics of frequency distributions, central tendency, variability, skewness. Central tendency is the characteristic of homogeneous items which exhibits their propensity to cluster around some one value. This value is used to describe the particular characteristic of the group as a

whole. It is usually some form of average. Variability is the tendency of a group of items to depart from the typical or average value. It enables one to estimate the importance of the departure of a given item from the typical value of the group. Variability is measured chiefly by means of the mean deviation (the arithmetic average of the deviations of the individual items from the arithmetic average of all items), or by the standard deviation (the square root of the average of the squares of the deviations of individual items from their arithmetic average).

Skewness measures the departure from symmetry. If the distribution is symmetrically arranged around its central tendency, it is said to have zero skewness. Distribution concentrated around the smaller values is said to have positive skewness, one concentrated around the larger values has negative skewness.

Index Number Construction. Index numbers are of two kinds, index numbers of prices and index numbers of physical quantities. Index numbers of prices measure the central tendency of various classes of prices. The various prices are weighted so that each has an influence on the resulting index number proportional with its economic influence in the determination of the price structure. The Index of Commodity Prices at Wholesale, prepared by the United States Bureau of Labor Statistics, is based on the actual prices of some 550 commodities. The average monthly price of each commodity is multiplied by the average annual quantity of that commodity marketed during the years 1925-27. The total for each month is then expressed as a percentage of the total for the same quantity of goods at the average prices that prevailed during the year 1926.

Index numbers of physical quantities enable the student to reason quantitatively about such factors as the general volume of production, total mineral production and the like. Such indexes are composites of individual time series which are usually corrected individually for seasonal variation and may or may not be corrected for secular trend. Index numbers of purchasing power are usually constructed to guide selling efforts in different sales territories. They are usually composites of such factors as population, number of income tax returns, number of automobiles registered, magazine circulation by states, countries and cities.

Correlation. Correlation is a statistical method of studying the character and degree of the relationship between two or more variables. It consists of the determination of an estimating equation, a measure of the error involved in using the equation and an abstract measure of the degree of relationship. The first is obtained by curve fitting in which the method of least squares is generally employed. This gives what is known as the equation to the line of average relationship. The scatter about this line is measured by the standard error of estimate. This is the square root of the average of the squares of the deviations and is taken to indicate the error which must be expected two out of three times.

Curvilinear correlation refers to relationships that

are described by curves rather than straight lines. Multiple correlation is an extension of the method of simple correlation to enable more than two variables to be handled.

Probability and Sampling. In most statistical problems it is impossible to obtain a complete enumeration of all the items in a given class and results are based upon a **SAMPLE**. Because of possible errors in random sampling, measurements based upon samples are tinged with a certain margin of uncertainty. This is measured by the probable error which designates the limits within which there is an even chance that the true value lies.

Graphical Presentation. The standard rules and principles that govern the graphical presentation of quantitative data are also part of the subject of statistics. See **CHARTS AND GRAPHS**. D. H. D.

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STATIUS, PUBLIUS PAPINIUS (c. 45- c. 96 A.D.), Roman poet, was born at Naples, about 45 A.D. From his father, a grammarian and poet of note, he received an excellent training. Early in life Statius distinguished himself by his poetic talent, winning many prizes in poetry contests in his native city, and three times gaining first honors at Alba. His two epic poems, both dedicated to the Emperor Domitian, have come down to us. They are the *Thebais*, a laborious work in 12 books, and the incomplete *Achilleis*, in 2 books. Also extant is the *Silvae*, a collection of occasional poems in 5 books. The compositions of Statius have considerable charm, but are often marred by insincerity and artificiality. His work suffers also from the servile flattery aimed at the eminent men of his time. The poet died at Naples about 96 A.D.

STATUARY HALL, the chamber in the Capitol at Washington, D.C., containing statues of historic Americans. The plan for a national statuary hall was adopted in 1864 and each state was asked to contribute marble or bronze statues of two representative citizens. Statuary Hall was formerly used as a meeting place by the House of Representatives before the Capitol was enlarged.

STATUE OF LIBERTY, or *Liberty Enlightening the World*, a gigantic bronze statue on Bedloe's Island in New York Harbor, representing a woman of heroic proportions holding high a torch which is illuminated at night. The statue is usually the first and last sight seen by ship's passengers returning to or leaving American shores. The gift of France to the United States to commemorate the centenary of American independence, it has become a symbol for the American spirit of freedom. The French sculptor, Frédéric Bartholdi, in visiting the United States, was so impressed with the eagerness of immigrants as they crowded the sides of the boat for their first view of America, that on his return home he proposed a popular subscription for the statue. The sum of \$200,000 was soon raised, and Bartholdi began his work. Made of thin sheets of hammered brass

laid over an iron framework, the figure is 111 ft. high, and the torch increases the height to 151 ft., 1 in. Inside the statue is a staircase leading to the top. The statue can be reached daily by boats which leave The Battery, New York City, for the 1¼ mi. trip northeast to the island.

STATURE. The stature of man which represents his total height in a fully erect posture includes a number of variable body segments: the legs, the trunk, the neck and the head, and is, therefore, with the exception of weight the most widely varying measurement. If we include all mankind the normal range of stature in males is from 130 cm., or 51 in., to 200 cm., or 78.7 in., and in females from 120 cm., or 47.2 in., to 187 cm., or 73.6 in. Below these limits are the dwarfs and above the giants, although the exact definition would vary in either direction depending on the normal range of a specific race.

That the endocrine glands influence stature cannot be doubted. Certain forms of giantism result from the overfunctioning of the pituitary gland, which when fed to experimental animals tends to produce an increase in size. The failure of the thyroid retards growth and is responsible for pathologically stunted individuals, known as cretins. When thyroid extract is administered to young cretins an increase in stature as well as a general improvement is noted. But aside from the endocrine glands there are other factors which affect stature. Ivanovsky demonstrated that during a famine period in Russia the stature was adversely affected to a considerable degree by malnutrition. The converse effect may also result from improved environmental conditions. The superiority of upper social classes for stature which has been so frequently noted may, however, be the result of a different racial composition rather than of a richer diet or of a more favorable environment. Certainly stature tables of the races of man reveal decided differences which cannot be attributed to environment or diet. There are numerous examples of a short stock dwelling in the same environment as a tall one, and of tall groups maintaining their superiority of stature over shorter ones despite a less favorable environment.

Races have been classified into five categories according to stature:

Very small:	below 150 cm. (male)
	below 140 cm. (female)
Small:	150 cm. to 160 cm. (male)
	140 cm. to 150 cm. (female)
Medium:	160 cm. to 170 cm. (male)
	150 cm. to 159 cm. (female)
Tall:	170 cm. to 180 cm. (male)
	159 cm. to 168 cm. (female)
Very tall:	above 180 cm. (male)
	above 168 cm. (female)

Among the shortest groups in the world are the pygmy peoples of Africa and Oceania. The average statures of the pygmies of the Congo, the Malay Peninsula, Melanesia, Philippines and Andaman Islands are between 138 and 152 cm. Some of the tallest people in the world dwell in Africa, particularly in the region of the headwaters of the Nile.

Stature also varies according to sex. In all races the males are taller than the females. The greater size of the male is an ancient phenomenon and is probably a function of his protective and fighting rôle.

Davenport has studied the inheritance of stature. His evidence points to the conclusion that tallness and shortness run in families, and that tallness is recessive to shortness. H. L. S.

STATUTES, laws proceeding from legislative authority as distinguished from precedents resting on the authority of the courts and administrative rules or orders by the authority of executive officers. Because of a distinction made in the Roman law, statutes are said to make up the written law as distinguished from judicial decision and traditional doctrine which make up the unwritten law. In the United States, statutes are distinguished from CONSTITUTIONS, the statutes proceeding from the legislature under the authority of the Constitution, and Constitutions proceeding from the authority of the people. As between COMMON LAW and statute, the statute prevails, but statutes are interpreted by the law of the common law, and it used to be and to some extent still is the rule that statutes in derogation of the common law are strictly construed.

STAUBBACH FALLS, a picturesque Swiss waterfall, situated in Bernese Oberland, a short distance south of the village of Lauterbrunnen. Descending 980 ft., it is turned to spray before striking the bottom of the valley. This explains its name, which means "dust-stream."

STAUNTON, a city in western Virginia, the county seat of Augusta Co., situated in the Shenandoah Valley, 130 mi. northwest of Richmond. It is served by bus lines and two railroads. This region is famous for its live stock, grain and apples. The chief local manufactures are furniture and men's clothing. In 1929 the factory output was valued approximately at \$2,000,000; the retail trade amounted to \$7,860,048. The city is the seat of Staunton Military Academy and other educational institutions. Woodrow Wilson was born here, and Cyrus McCormick, inventor of the reaping machine, lived near by. Several large caverns and a Natural Bridge are in the vicinity. Staunton was settled in 1731, 2 mi. east of the present site. The State General Assembly took refuge here during the Revolution. During the Civil War the Northern troops occupied the city on two occasions. Staunton has a National and a Confederate cemetery. The city was chartered in 1870. Pop. 1920, 10,623; 1930, 11,990.

STAVANGER, a city of Norway, capital of the district of Rogaland on the Bokn Fjord, with railroad to Egersund. It stands on rocky ground, rebuilt after repeated fires. It has a Norman and Gothic style cathedral built in the 12th and 13th centuries. The interior was restored in 1866. Stavanger possesses advanced schools, a library, museum and an excellent harbor protected by islands. The city engages in shipping and exports fish and agricultural products. Pop. 1930, 46,780.

STAVE. See **STAFF**.

STAVESACRE (*Delphinium Staphisagria*), a small species of larkspur native to southwestern Europe and Asia Minor. It is a downy plant, 1 or 2 ft. high, with palmately cleft leaves and bluish-purple flowers borne in dense terminal clusters. The seeds, which contain the poisonous alkaloid delphinine, are used in various insecticides.

STAVROPOL, an important grain center of the North Caucasian Region of the R.S.F.S.R., southeastern European Russia. It is situated on the northern slopes of the Caucasian range on a plateau over 2,000 ft. above sea level. The town was founded in 1777 as a fort on the Petersburg-Tiflis route, becoming the capital of the Caucasian region in 1882. It is on the railway from Rostov-on-Don. Commerce with Georgia, Persia and Armenia flourishes. Stavropol has prosperous oil works, and makes machinery and textiles. Pop. 1926, 58,657.

STEAD, WILLIAM THOMAS (1849-1912), English journalist, was born at Embleton, Northumberland, July 5, 1849. In 1880 he went to the *Pall Mall Gazette* as assistant editor and from 1883-89 served as its editor. In 1890 Stead founded a monthly *Review of Reviews*, and the following year established the same magazine in the United States. Among his numerous works are *If Christ Came to Chicago* and *The Americanization of the World*. He was interested in psychical research and in 1893-97 published a periodical, *The Borderland*, for recording spiritualistic experiences. Stead died in the *Titanic* disaster, Apr. 15, 1912.

STEAM. Pure steam, or water vapor, is a dry, invisible gas. As ordinarily considered, however, *steam* is the vapor from boiling water. The white cloud often seen above the spout of a tea-kettle or the whistle of a locomotive consists of water vapor mixed with minute drops of water formed by condensation. Such a mixture is called, technically, *wet steam*; similarly, pure steam is called *dry steam*.

Dry steam is a saturated vapor (see **VAPORIZATION**). Hence, its pressure depends only upon its temperature. If its temperature is raised after it leaves the **BOILER**, without a corresponding increase in pressure, the steam becomes *unsaturated* or *super-heated*. The "degree of super-heat" is the difference between its actual temperature and the temperature at which it would be saturated at the same pressure. The use of super-heated steam in modern **STEAM ENGINES** has helped to increase their efficiency.

The **SPECIFIC HEAT** of *dry saturated steam* is a negative quantity. This is because an increase in temperature requires an increase in pressure to maintain the condition of saturation. But at the higher pressure, the specific volume, i.e., the volume of unit mass, is actually less than it is at the lower temperature and corresponding pressure. The work necessary to produce the decrease in volume is equivalent to more than the heat necessary to raise the temperature of the vapor by the corresponding amount. Hence, heat must actually be taken away if the steam is to

remain saturated when its temperature is raised. In other words, if a mixture of water and steam is compressed adiabatically, i.e., without gain or loss of heat (*see ADIABATIC CHANGE*), some of the water will be vaporized.

Among other quantities of great interest to the engineer are the *ENTROPY* of steam, and also its total *HEAT*. Many attempts have been made to express, in mathematical formulas, such relations as those between the temperature, pressure and specific volume of steam. Some of these empirical equations hold quite accurately over a more or less limited range, and many of them are very useful. Such books as Marks' and Davis' *Steam Tables* or Peabody's *Steam and Entropy Tables* give in tabular form the data required by the student of steam engineering.

At 100°C. and one atmosphere of pressure, the specific volume of water is 1.043 cu. cm. and the specific volume of steam is 1,671 cu. cm. Under these conditions it requires 539 CALORIES to convert the water into steam without change in temperature. At the critical temperature, 374°C., and the critical pressure, 217.7 atmospheres, the specific volumes are equal and no heat is required to vaporize the water. *See also SUPERHEATER.* W. W. S.

STEAM ACCUMULATOR, an insulated vessel used for storing in water the heat energy of steam at saturation temperature. The steam to be stored is condensed in the water and gives up to the water its *LATENT HEAT*, both the temperature and pressure within the vessel increasing during the charging or storing period. Recovery of this stored energy for use is accomplished by reducing the pressure in the vessel, a process of ebullition taking place and practically the entire amount of heat stored is recovered in the discharged steam.

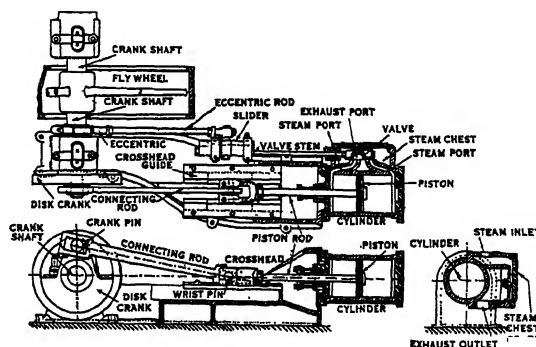
Commercially, there are two types of steam storage systems utilizing the accumulator as an essential part of the system. The low pressure type, such as the Rateau and Smoot, is usually charged with exhaust steam from prime movers. These systems are capable of equalizing small fluctuations of short duration in low pressure lines. The high pressure, or Ruths type, is such that "peaks" in the supply in either high, low or intermediate pressure lines are absorbed by the accumulator, and given off when the demand is greater than the momentary boiler capacity. This renders the steam supply independent of the consumption so long as it is sufficient to meet the *average* demand. G. M. C.

STEAMBOAT SPRINGS, a town in northwestern Colorado, the county seat of Routt Co., situated about 110 mi. northwest of Denver on the Denver and Salt Lake Railroad. Medicinal mineral springs have made the town a popular health resort. The chief manufactures are flour, lumber, prepared cereals and butter. Hay, grain, potatoes and berries are grown in this region. Pop. 1920, 1,249; 1930, 1,198.

STEAM CALORIMETER, an apparatus used in determining the total heat contained in *STEAM*. Its practical value lies in its use in the testing of *STEAM*

GENERATORS to determine efficiency. Since an installation is "rated" by the amount of dry or saturated steam produced by it under defined conditions, it is essential that the amount of superheat contained in the steam be known. If this figure be determined, it can be used—with the amount of water fed to the *BOILER* and the amount of fuel burned—to arrive at a figure representing the efficiency of the installation. In general, the steam calorimeter determines the degree of superheat at any moment by passing steam through a condenser and noting its temperature as well as the temperature and the amount of the condensate. By the use of standard tables that show the characteristics of steam at various temperatures, the total heat in the steam can be calculated. Steam calorimeters are of several types, but all depend upon the same principle.

STEAM ENGINES, machines for converting the heat energy of *STEAM* into mechanical energy. They are divided into two broad classes, expansion, and non-expansion. In each case the engine is made up of a cylinder, into which steam from a *BOILER* is admitted through a *VALVE*, and a *piston* upon which the steam pressure is exerted, and which travels from one end of the cylinder to the other, its motion being transmitted by a *connecting rod* to the *crankshaft*, causing the latter to revolve a half of a revolution while the piston travels the length of the cylinder. When the end of the piston stroke is reached the valve is shifted by an eccentric on the crankshaft, or by other suitable means, to permit steam to enter the other end of the cylinder, forcing the piston back to its original position, while the steam employed during the first stroke is passing out through the exhaust ports. Fig. 1 shows a simple slide-valve engine with the cylinder cut away to reveal the valve, steam ports and piston. There are many variations from this basic design. The cylinder may have four valves in place of one—a



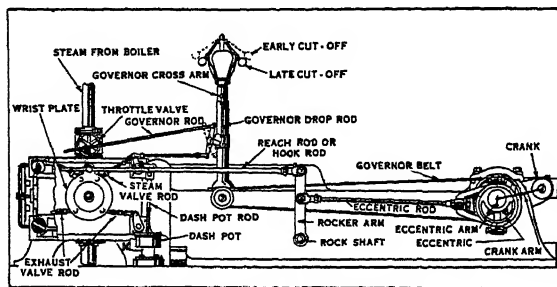
FROM L. H. MORRISON, VALVE SETTING, MCGRAW-HILL BOOK CO.

FIG. 1. SLIDE VALVE ENGINE

Basic design with cylinder cut away to show the valve, steam port and piston

steam valve, and an exhaust valve for each end. Or the cylinder may have only the steam valves and be provided with a center port to exhaust the spent steam, this being a *UNIFLOW ENGINE*.

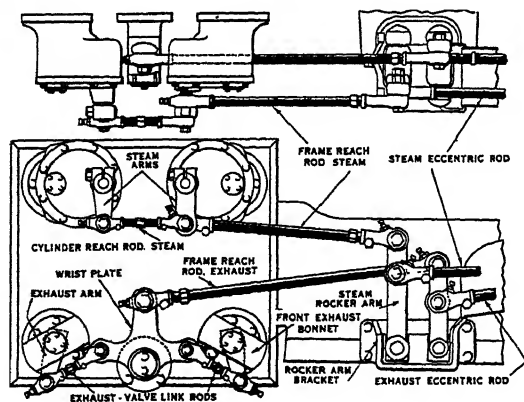
The four-valve engine is a double-acting expansion steam engine employing four valves, two of which are intake valves and the other two exhaust valves. One intake and one exhaust valve are located in the two head ends of the cylinder. The best known of these four-valve engines is the Corliss, developed by George Corliss and later modified and improved by



FROM L. H. MORRISON, VALVE SETTING, MCGRAW-HILL BOOK CO.

FIG. 2. CORLISS FOUR-VALVE ENGINE

many other builders. A typical Corliss unit is shown in Fig. 2. The principal features distinguishing the Corliss engine are the rotating valves and the governor-controlled cut off of the steam valves. The machine has a "wrist" plate driven from an eccentric on the shaft. The plate is equipped with "reach" rods and bell cranks connected to the four valves. The steam-valve mechanism is so designed that the motion of the wrist plate permits a latch to engage the steam-valve bell crank and open the valve at the proper time to admit steam into the cylinder. The governor is



FROM L. H. MORRISON, VALVE SETTING, MCGRAW-HILL BOOK CO.

FIG. 3. VALVE GEAR OF BALL ENGINE

The eccentric, controlled by the governor is connected to the valves through the eccentric rods, thus controlling the steam supply

connected to "knockoff" cams so that at the proper time the valve is disengaged from the wrist plate mechanism and is then closed under the suction action of the "dash pot."

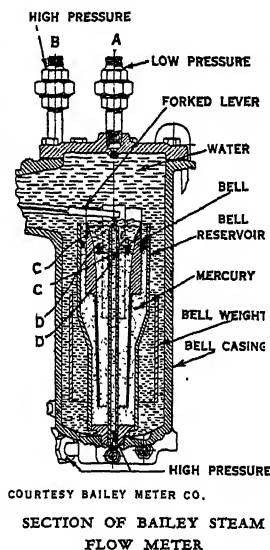
At an increase in load the engine will start to slow down, causing the governor to revolve more slowly and the governor weight arms to move inward, forcing the governor collar to shift downward and alter the

position of the valve knockoff cam to enable the steam valve to remain open longer and permit more steam to enter the cylinder.

To eliminate the Corliss cutoff mechanism and the dash pots, which limit engine speeds to 150 revolutions per minute, another type of four-valve engine has been produced. In it an automatic shaft governor is mounted in the flywheel and connected to the four valves, as shown in Fig. 3. Control of the steam supply is brought about by the governor altering the throw of the eccentric and thus the amount of valve opening.

L. H. Mo.

STEAM FLOW METERS, instruments for measuring the rate or volume of flow of steam through a pipe, similar meters being used for measuring the flow of other fluids. Aside from the *Pitot Tube*, there are two main types of flow meters; those which operate on a pressure-differential principle and the rotary type which are operated by kinetic energy. In the pressure-differential type the flow of steam is constricted by a venturi tube (*see VENTURI METER*), nozzle or orifice, producing a higher pressure on the upstream side of the opening than on the opposite side. These pressures vary with the rate of flow. The indicating part of the meter is designed to translate the pressure difference into rate of flow or volume of flow. It is connected to the main line by taps on the high and low pressure sides of the constriction. To illustrate the operation of the



COURTESY BAILEY METER CO.

SECTION OF BAILEY STEAM FLOW METER

the indicating part of the meter, a section of a Bailey steam flow meter is shown. The low pressure steam enters at *A*, pushing on the water which transmits the force to the mercury surface *CC* and the top of the bell. The high pressure steam enters at *B* and pushes up on the bell and down on the mercury at *DD*. The differences of the high and low pressures produce movement of the indicator. Since the velocity of flow varies as the square root of the pressure difference, some means is needed to produce equal increments of movement of the pointer. This is accomplished by the variance in the area of the mercury surface *DD* and in the buoyant force of the mercury as effected by the tapering sides *FF*.

The rotary steam meter comprises a turbine operating in a shunted circuit, the motion of the turbine being transmitted to a counter dial by a magnetic drive.

A boiler-load steam flow indicator is used for checking boiler output and comprises a diaphragm balanced by springs and operated by a pressure differential.

Steam flow meters are used to check the output or intake of steam; to detect inefficiency in a boiler; to enable steam flow to be controlled accurately; and to make acceptance tests on boilers.

STEAM GENERATORS, a term that covers the recently developed combination of water-tube BoILERS, water-walls, super-heaters and economizers for the generation of steam. Certain installations have been made in which the boiler, as a place where ebullition takes place and by whose accumulator action sudden fluctuating power demands are met, is omitted, though these are not commonly designated as steam generators.

For a long time boilers have been "rated" or classified as to size or capacity by an arbitrary unit, a "boiler horse-power." The accepted derivation of this unit is the generation of $34\frac{1}{2}$ pounds of steam at 212° F. per hour from feedwater at the same temperature. This calls for the utilization of 33,523.6 BRITISH THERMAL UNITS. The efficiency of a boiler or steam generator can be stated as follows:

$$E = \frac{T - (t - 32)}{H}$$

where T is the total heat in steam; t the total heat in feedwater and H the heat in the coal burned.

Because of growing demands for increased capacity and higher efficiency, combustion methods have greatly improved and additional heat-absorbing surface in the form of ECONOMIZERS and air preheaters (*see also* HEAT EXCHANGE EQUIPMENT) have been added to the boiler. This added surface reduces the temperature of the gas leaving the boiler, absorbing heat from it and returning it to the system in the form of higher temperature feed water, or to the furnace as heated air for combustion. The result is higher thermal efficiency. Furthermore, the use of extended surfaces makes it economical to operate the installation at much higher rates of evaporation. In present-day units of large or moderate sizes, evaporation rates of 10 to 15 pounds of water per square foot of surface are as common as were 5 or 6 pounds a generation ago.

The development of pulverized coal firing, and the parallel introduction of water-cooled FURNACES, has greatly changed the design of steam generating units. A modern unit may consist of a boiler; a furnace with fully or partly water-cooled walls; a superheater located in the furnace; suitable mechanical STOKERS, or perhaps burners for introducing pulverized coal or fuel oil into the furnace; mills for pulverizing coal, and "feeders" to control and regulate the amount of fuel fed. An economizer or an air-preheater, or sometimes both, may also be installed, the relative proportions of the surfaces of which may be varied greatly, depending upon various conditions of operations. High-capacity units are usually provided with forced-draft and induced-draft FANS. Flues or ducts between the combustion chamber and the economizer or stack all go to make up a complete steam generating unit.

Such units are designed for a wide range of pres-

ures and temperatures. The majority of present-day large capacity installations are built for pressures of 450, 550, 600 and 1,200 pounds, and for temperatures of 700 to 825° F. Riveted drums are used on "bent tube" boilers working at pressures up to 500 pounds, and on sectional-header boilers carrying pressures up to 700 pounds. Above these limits, forged or welded drums are used. Units of 1,000,000 to 1,500,000 pounds of steam at pressures of 450 to 1,300 pounds, and temperatures of 750° to 825° F. are obtainable. In the future, even larger sized units may be looked for.

J. VAN B.; K. T.

Efficient Testing of a Steam Generator is the determination of the amount of heat *utilized* in terms of the amount of heat *introduced* in the FURNACE as fuel. The principal determinations to be made are the weight of water evaporated, the temperature of the feed water, the pressure and the temperature at which steam leaves the SUPERHEATER, the weight of fuel burned and the heat value of the FUEL.

The results of an efficiency test are first expressed in pounds of steam made per pound of fuel fired, by dividing the total weight of water evaporated by the total weight of fuel burned. The heat utilized per pound of fuel is obtained by multiplying the weight of water evaporated per pound of fuel by the heat required to make one pound of steam from the feed-water available. The efficiency expressed in per cent is obtained by dividing the heat utilized per pound of fuel by the thermal, or heat value of one pound of fuel, and multiplying the quotient by 100.

The heat per pound of steam for any feed water temperature, steam pressure, and steam temperature, is obtained from standard tables of properties of STEAM. The produced heat per pound of coal burned is obtained by determining in a calorimeter (*see* CALORIMETRY) the heat value of a representative sample of the FUEL. The most important part in the determination of the heat value of fuel is the collection and the preparation of a sample (*see* SAMPLING) that truly represents the entire weight of fuel burned, and it is in this part of the task of testing that serious errors occur. The weight of water fed to the steam generating (*see* STEAM GENERATORS) unit is obtained either by direct weighing or metering. The fuel burned is weighed. The temperature of the feed water is measured by a thermometer placed in a thermometer well in the feed pipe. The steam pressure is measured with a PRESSURE GAUGE. The temperature of the steam leaving the superheater is measured with a thermometer or thermocouple PYROMETER placed in a thermometer well in the steam pipe. If the boiler is not equipped with a superheater, a steam calorimeter is used to determine the moisture in the steam.

In efficiency testing data are usually determined so that a check may be obtained, the percentage of heat utilized plus the percentage of heat lost being equal 100%.

Heat losses include: Heat carried away by the chimney gases; Incomplete combustion; and Radiation

losses. The first item is generally the largest and the one that varies the most. For its computation it is necessary to determine the weight of the products of COMBUSTION per pound of fuel, the temperature at which they leave the heat absorbing surfaces of the steam generating unit and the temperature of air used in combustion. The fuel sample must be analyzed for moisture, total carbon, hydrogen and sulphur. The products of combustion must be analyzed for carbon dioxide, oxygen and carbon monoxide. From the analysis of the products of combustion and the analysis of fuel the weight of the products of combustion per pound of fuel can be computed. The products consist of dry gases and water vapor resulting from the moisture in fuel and from burning the hydrogen of the fuel. There is also a small amount of water vapor in the atmospheric air used in combustion. The heat contained in the dry gases is entirely sensible heat and is computed by multiplying the weight of the gases by the average SPECIFIC HEAT and by the difference between the temperatures of gases and room air. The heat contained in the water vapor formed from the moisture and hydrogen in fuel consists largely of LATENT HEAT and only to small extent of sensible heat. The heat loss in the vapor in the air is entirely sensible heat, because the water in the air is already completely vaporized. The heat content of the water vapor can be calculated, or obtained from the steam tables.

The incomplete-combustion losses are determined from the carbon-monoxide content of the fuel gases, the amount of carbon in the cinders or dust carried by the products of combustion and the weight of ash pit refuse and its carbon content.

The radiation losses can be estimated with reasonable accuracy, usually being between 1 and 2% of the heat in fuel.

Standard methods of conducting efficiency tests are recommended by the subcommittee on "Test Code for Stationary Steam Generating Units" of the Power Test Code Committee of the American Society of Mechanical Engineers. H. KR.; K. T.

STEAM HAMMERS, machines in which a hammer is driven by steam against hot metal; they are usually vertical and used for heavy forgings. The ram or *tup* is driven by a steam cylinder, the size of the hammer being designated by the weight of the hammer head. The steam hammer mechanism is similar to that of a single cylinder steam engine.

STEAM PLOWS, gang plows mounted on wheels and drawn by a steam traction engine. They usually comprise from 12 to 18 or more 12 in. plow units, and they will turn over from 25 to 40 acres per day. They are now largely replaced by tractor plows. See also PLOWS.

STEAM ROLLER. See ROAD MACHINERY.

STEAM ROLLER, an American political term referring to the autocratic methods by which opposition is sometimes crushed in a nominating convention (see CONVENTION, POLITICAL), particularly in the seating of "regular" delegates. The metaphor originated in

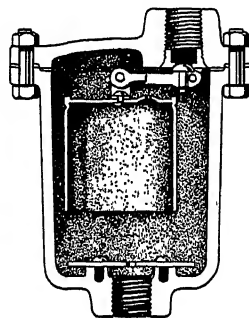
the Republican convention of 1908 and was used generally by the press in reports of the convention proceedings four years later.

STEAM SEPARATOR, a device for removing the moisture from steam. It is, essentially, an enlargement in the piping, in which the steam velocity is reduced and the particles forced to travel in a zigzag direction against a surface which is corrugated or provided with lips. This surface directs the steam to the outlet, but it catches the particles of moisture which are separated from the steam by their inertia.

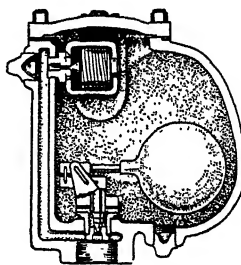
Another type of separator, also called a *purifier*, throws the moisture and foreign particles from the steam by centrifugal action. This type essentially comprises a cylindrical container with directing vanes which give the steam a whirling motion as it passes through the device at high velocity. The moisture and foreign particles are thrown against the sides of the container and drained off through a bottom outlet.

A third type, known as the Tracyfier purifier, comprises a number of rows of baffle plates which break the steam up into thin streams. The velocity of the steam is low and the moisture adheres to the plates and is drained off by gravity.

STEAM TRAPS, automatically controlled mechanism located in steam lines, the function of which is to allow the discharge of water, separated (see STEAM SEPARATOR) or condensed from steam, without permitting the steam itself to escape. Steam traps are



INVERTED BUCKET TYPE
STEAM TRAP



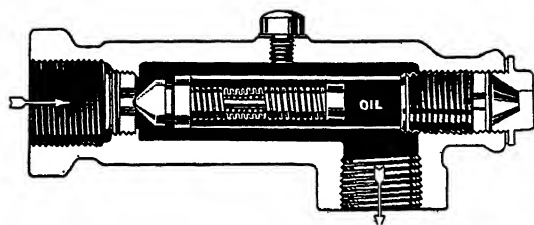
COURTESY THE SARCO CO.

COMBINATION FLOAT AND
THERMOSTATIC STEAM TRAP

Condensate collected in the trap floats the ball, opening the valve. The thermostatic valve permits air to enter but prevents the entrance of steam

used on any steam apparatus from which it is necessary or desirable to remove the condensate as rapidly as it accumulates, as in steam separators, heating coils, radiators, and steam jackets. The steam trap is essentially a closed container having a valve that automatically opens to permit the steam pressure to discharge the condensate, closing as soon as the trap is empty. Traps are classified according to the manner in which the automatic valve is operated, as *float*, *inverted-bucket*, *tilting-bucket*, *open-bucket*, and *thermostatic*. In the float and inverted-bucket types the float and bucket rise with the level of the condensate and open the valve. In the tilting-bucket trap the condensate overflows into the bucket, causing it to

tilt and open the valve; then a jet of steam strikes the bottom of the bucket and removes the water, allowing the bucket to rise and close the valve. The thermostatic trap comprises a steam-pipe body having a



COURTESY THE SARCO CO.

THERMOSTATIC STEAM TRAP

Collected condensate cools the oil and the cartridge coil, opening the valve. Steam entering the trap expands the oil, forcing the plunger outward and closing the valve

cartridge containing a spirally corrugated tube and a heavy oil, one end of the cartridge carrying a valve head. When condensate collects, the oil and the coil are cooled and contract, opening the valve. The incoming hot steam then causes the valve to close.

STEARIC ACID, one of the three principal FATTY ACIDS, occurring in oils and fats. Chemically it belongs to the group of acids derived from the saturated chain hydrocarbons, of which group formic and acetic acid are the simplest representatives; its chemical formula is $\text{CH}_3(\text{CH}_2)_{18}\text{COOH}$. In the pure form, it appears as a colorless crystalline substance, devoid of taste and odor, but in nature occurs almost exclusively as its glyceride, in combination with the trihydric alcohol glycerine; this compound is the chief constituent of the harder fats such as tallow. Sodium stearate is a principal component of hard soap, potassium stearate of soft soap.

STEATITE. See TALC.

STEATOPYGIA, a form of buttocks development characteristic of Bush-

WOMAN OF BUSHMAN TRIBE
WITH STEATOPYGIA

man and Hottentot women. Among the females of these people the buttocks frequently consist of an enormous deposit of subcutaneous fat which produces a marked posterior protuberance. It has been suggested that the difficult living conditions in which the Bushman and Hottentot live and the scantiness of their

food supply make necessary this form of food storage in the shape of excess fat. During periods of famine this deposit serves as a useful source of energy.

Milder forms of steatopygia are sometimes seen in women of other races. The paleolithic "Venuses" found in Europe are occasionally characterized by steatopygia. H. L. S.

STEATORRHEA. See PANCREAS.

STEDMAN, EDMUND CLARENCE (1833-1908), American poet, was born at Hartford, Conn., Oct. 8, 1833. He attended Yale College for only two years, but later received honorary degrees. In 1860 he became editor of the *New York World*, but abandoned this post to become a war correspondent. Besides editing a number of anthologies of poetry and a library of American literature, he published *Victorian Poets*, 1875, *Poets of America*, 1885, and *The Nature and Elements of Poetry*. In his *Poems, Lyrical and Idyllic*, 1860, appear his best known poems. *An Idyl of the Great War* appeared in 1863 and *The Blameless Prince* in 1869. Stedman died in New York, Jan. 18, 1908.

STEEL. See IRON; AUSTENITIC STEELS; BESSEMER STEEL; BLISTER STEEL; CAST STEEL; CHROMIUM STEELS; CRUCIBLE STEEL; MANGANESE STEEL; NICKEL STEEL; TOOL ALLOYS; VANADIUM STEEL; SILICON STEELS; STEEL MANUFACTURE.

STEEL, STAINLESS. See ALLOY; CHROMIUM STEEL.

STEELE, SIR RICHARD (1672-1729), Irish essayist, dramatist, journalist and politician, was born in Dublin, in Mar. 1672. He was educated at the Charterhouse, London, where he began his long friendship with JOSEPH ADDISON, a fellow pupil, and at Christ Church, Oxford. He did not graduate but entered the army, serving as a cadet for several years. In 1709 he founded *THE TATLER*, on which he was soon joined by Addison, and wrote the majority of the famous essays appearing in it and a good number of those in *THE SPECTATOR*, which he and Addison began in 1711. His fame rests chiefly on these essays, which in literary value are generally considered to equal those of Addison. His dramas, two of which were *The Conscious Lovers* and *The Lying Lover*, were not of lasting importance. Steele started many other papers and was a member of Parliament, from which he was expelled, charged with the writing of an allegedly seditious pamphlet, *The Crisis*, which supported the claims of the Hanoverian dynasty; in answer to this charge he published in 1714 *An Apology for Himself and His Writings*. On the accession of George I Steele was rewarded with a knighthood and many honors and gifts. He died at Carmarthen, Wales, Sept. 1, 1729. See also ENGLISH LITERATURE; ESSAY.

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STEEL-ENGRAVING, line-engraving on steel. Steel-engravings were introduced early in the 19th century. Their vogue for book illustration, due to the durability of the plates, and the making of fram-

ing prints did not long survive the Civil War. The "fineness," precision and stereotyped regularity of the work had a certain popular appeal. It was never a medium for original, artistic expression.

STEELHEAD, a valuable game and food fish (*Salmo gairdneri*), called also steelhead trout and salmon trout, found in coastwise streams and in the Pacific Ocean from Oregon to Alaska. It attains a length of 2½ ft. and a weight of about 4 lbs., but sometimes reaches 20 lbs. Like the rainbow trout, to which it is very closely related, the steelhead is noted for its handsome coloration. The true rainbow trout (*S. irideus*) of the California Coast ranges, is also called steelhead when it descends into the sea where it attains much greater size than in the streams. In 1929 the commercial catch of steelhead in United States waters, chiefly near the mouth of the Columbia river, was 3,254,000 lbs., valued at \$305,000, utilized largely for canning.

STEEL MANUFACTURE. The essential constituent of steel is the element iron, occurring in nature as iron ore: hematite, siderite, limonite, magnetite, etc. Steel can be made directly from iron ore but the universal practice which is more economical is to reduce the ore by means of carbon in the blast furnace. The product of this reduction is "pig iron," substantially the sole intermediate from which all iron and steel products are derived.

The modern blast furnace is a precisely tapered circular tower about 90 or 100 ft. tall, covered externally with a steel shell and lined with fire brick. For every ton of pig-iron produced, about one ton of coke, 2.2 tons of ore, and 0.5 ton of limestone are poured into the top of this stack and 4.4 tons of heated air are blown in near the bottom, above the slag line. Once lighted the furnace maintains its bottom high temperature of 2000° C. continuously. The iron, reduced from the ore, collects as a liquid in the hearth. Above it floats the molten blast furnace slag, the function of which is to flux away many impurities of the ore. It is largely a lime-silicate mixture and, by weight, is produced half as fast as the pig-iron. Five or six heats of one hundred or more tons each are tapped from the furnace per day. Slag is more frequently flushed off. Combustible gases from the top of the furnace are led down and burned to provide the hot air blast.

Solidified pig-iron, though fairly strong, is a brittle alloy containing 3.5-4.2% carbon, largely as graphite, and roughly 1.5% each of silicon and manganese.

Pig-iron, molten or solidified, is put in the steel making furnace, where most of the carbon and other non-ferrous elements are oxidized out and the non-metallic impurities are rejected. Pig-iron and scrap now constitute the sole sources of the iron for tonnage steel; the crucible and cement steel processes employing wrought iron are essentially obsolete as factors in quantity production.

Practically all steel is the product of the Open Hearth (Siemens-Marten) Furnace, the Bessemer Converter, or the Electric Furnace, each having either

basic or acid lining. In the Duplex process, steel is conditioned successively in two types of furnaces.

Open Hearth Steel: Scrap and solid or molten pig-iron are melted under a flame in the presence of iron ore, with either silica (acid) or lime (basic) acting as purifying agents. Additions to deoxidize and control composition are added to the molten, purified metal.

Bessemer Steel: Molten pig-iron is purified in a vertical, egg-shaped vessel by air blast, and additions to deoxidize or control compositions are made to the molten steel.

Electric Steel: Scrap and molten or solid pig-iron are melted by heat generated electrically in contact with oxidizing, and subsequently with reducing slags. Various alloy additions are made to the metal bath kept molten by electricity.

The refined melt from any of the above processes is cast into ingot molds. The resulting ingots are rolled, forged, or pressed into bars, plates, standard shapes, etc. Most steels make satisfactory direct castings by suitable foundry practice. E. C. BA.

STEELTON, a borough of Dauphin Co., Pa., on the Susquehanna River, 3 mi. southeast of Harrisburg. It is served by the Pennsylvania, the Reading and the Steelton and Highspire railroads, motor bus lines and a nearby airport. It has a limestone quarry and steel is extensively manufactured. In 1929 the retail trade amounted to \$3,661,968. Steelton, once named Baldwin and laid out in 1866, was founded in 1880 by officials of the Pennsylvania Steel Corporation. Pop. 1920, 13,428; 1930, 13,291; about 15% foreign-born; 25% colored.

STEEL WOOL, fine shavings of steel cut from a wire or rod and resembling curled hair. They have sharp edges which makes them a good ABRASIVE for finishing wood or soft metals.

STEEN, JAN HAVICKSZ (1626-79), Dutch genre painter, was born in 1626 at Leyden. He studied at Utrecht with Nicholas Knupfer and worked at Haarlem with Adrian van Ostade and Jan van Goyen. At Delft Steen is believed to have followed his father's profession of brewer. He obtained a permit in 1672 to conduct an inn. Accounts of Steen's life vary; some of his biographers believe him to have been a drunkard. It is known that his pictures were seized and sold by an apothecary of Delft to whom he owed a trifling debt. His canvases, of which Hofstede de Grote records nearly 1,000, cover a wide range of subjects. Although Steen failed in his religious works, his inn scenes, his wedding feasts and St. Nicholas festivals have a coarse but wholesome humor and reveal a keen sense of the dramatic. His work is clear in color, correct in drawing, lively in spirit. Steen died at Leyden, Feb. 3, 1679.

STEEPLECHASING, horse racing over a series of hurdles, which may be fences and walls, or artificial obstacles such as water jumps. Formal recognition of steeplechasing was first obtained about 1865 in England. Its misleading name derives from the name



PHOTO BY C. C. COOK

A PERFECT JUMP IN AN ENGLISH STEEPLECHASE

The illustration shows the successive positions of horses taking a hurdle in a steeplechase.

given to a much older variety of racing, in which riders rode over rough country to a prominent landmark, such as a church steeple. In its modern form, steeplechasing is run over flat racing courses, in which fences and hurdles are moved into place. Thus the public can see the races, which was impossible when the steeplechase was a cross-country event. An annual event in England is the Grand National Steeplechase, held at Liverpool. This is the most difficult steeplechase course, presenting some 30 obstacles in a course of 4 miles, 856 yards. In America steeplechasing was formally organized in 1850, when a race was held near Montreal. Under the leadership of hunt and country clubs, steeplechasing in the United States grew steadily in public favor, and races were held regularly on Long Island, Richmond, Va., Philadelphia, Detroit, Chicago and elsewhere. In 1891 this form of racing gained further support when August Belmont organized the National Steeplechase Association. The element of danger to horse and rider in the steeplechase gives this form of racing a spectacular complexion, which chiefly explains its popularity with the public. *See HORSE RACING.*

STEERING GEAR, on a **MOTOR VEHICLE**, the wheel, gearing, and **LINKAGE** connected with the wheels making it possible for the driver to guide the vehicle. One form consists of a **WORM GEAR**, mounted on the steering wheel shaft, which meshes with a nut that actuates the linkage. Another form uses a gear and a sector. In some of the larger vehicles steering connections are made to all four wheels, although, usually, only to the two front ones. Occasionally, a **TORQUE AMPLIFIER** is interposed between the steering wheel and the linkage.

On a vessel, the steering gear functions by turning the **RUDDER** from right to left or vice versa. Steering gears for sail craft and small vessels are hand operated, and may control the rudder through a hand-wheel, drum, rope and tiller.

For larger craft as cargo steamers, passenger vessels and warships, power other than hand is necessary. For a cargo steamer, a steam steering engine may be located aft in the **POOP**, which through a rudder quadrant turns the rudder, the steam to the engine being controlled by a valve operated by rope and sheaves from the steering wheel in the pilot house or by a telemeter system where pipes filled with non-freezing liquid take the place of the ropes and sheaves. Instead of a steam engine an electric motor may be used, while on large warships a combination of hydraulic and electric units is often installed. Ships with power operated steering gear must be equipped also with hand operated gear for use in case of damage to the power.

Mention should also be made of the gyro-pilot called "Iron Quartermaster" or "Metal Mike," which detects deviations from a ship's course. Installations have been made where the steering is done automatically.

BIBLIOGRAPHY.—*Gyro-compass & Gyro-pilot*, Sperry Gyroscope Co., N.Y.

STEFANI, ALBERTO DE (1879-), Italian statesman, was born at Verona Oct. 6, 1879. For some years he taught political economy at the Superior Commercial Institute at Venice. An ardent Fascist, he was elected to the Chamber in 1921, and was named by Mussolini minister of finance and finally head of the treasury. By rigid economies and a reorganization of state finances, he wiped out a large debt and created a surplus of approximately 200,000,000 lire. Being unable to control speculation during the critical financial period in the spring of 1925, he resigned.

STEFAN'S LAW, a fundamental law in **RADIATION OF HEAT** which states that the total energy radiated per second per square centimeter by any substance is proportional to the fourth power of its absolute temperature (*see ABSOLUTE TEMPERATURE SCALE*). In symbols: $E = CT^4$, where E is the energy radiated per sec. per sq. cm., and C is a constant, the value of which depends upon the nature of the radiating surface. This law was originally deduced for a black body by Stefan from experimental data. Later **BOLTZMANN** derived it theoretically by thermodynamic reasoning, and it is frequently called the Stefan-Boltzmann Law.

STEFANSSON, VILHJALMUR (1879-), Arctic explorer, was born at Arnes, Manitoba, Canada, Nov. 3, 1879. After graduating from the University of Iowa, he studied anthropology and theology at Harvard. His first expeditions were to Iceland. In 1908-12 he explored regions in the Arctic for the American Museum of Natural History and the Geographic Survey of Canada, discovering blond Eskimos who had never been visited by white men. In 1913 he was sent by the Canadian Government, to the Arctic regions, and remained there for five years, during which time he discovered Prince Patrick Land, Brock and other islands, and made a study of the commercial value of the Arctic region. In 1924 he visited Australia and explored the Macdonnell mountains. Stefansson is the author of *My Life with the Eskimo*, *The Friendly Arctic*, *Stefansson-Andersen Expedition 1909-12*, *Hunters of the Great North*.

STEICHEN, EDUARD J. (1879-), American painter, was born at Milwaukee, Wis., in 1879. He specialized in landscapes and figure subjects, and has mural decorations in the Luxembourg Museum, Paris. Steichen was chief of the Photographic Section, Air Service, A.E.F., in the World War. His works include *Nocturne: Temple of Love*, in the Metropolitan Museum, New York, and *Across the Marshes*, Toledo (O.) Museum.

STEIN, GERTRUDE (1876-), American writer, was born in 1876 at Allegheny, Pa. Much of her childhood was spent in Vienna and Paris. She was graduated from Radcliffe College and in medicine at Johns Hopkins University, but at 28 returned to Paris to write. A leader of the advanced school of writing which includes **JAMES JOYCE**, she attempts to convey meaning through the sounds of words arranged in extraordinary patterns regardless of all conventions. Gertrude Stein is the author of novels, poems, short

stories and literary portraits, her works including *Tender Buttons*, *Three Lives*, *The Making of Americans*, *Useful Knowledge*, *Before the Flowers of Friendship Faded*, *Friendship Faded*, 1931, and *Lucy Church Amiably*, 1931.

STEIN, HEINRICH FRIEDRICH KARL, Baron vom und zum (1757-1831), German statesman and political reformer, was born near Nassau on Oct. 26, 1757. He studied law at the University of Göttingen, and became minister of mines for Prussia. He interested himself in foreign political institutions and held various administrative offices up to his appointment in 1807 as Prime Minister of Prussia. In this capacity he introduced many reforms which included the abolition of serfdom and the establishment of self-government in Prussian municipalities. In 1808 Stein was forced to resign and flee to Austria because of an indiscreet letter which came to the attention of Napoleon, then virtually master of Europe. But by 1813 he had again come to the front and was active in the administration of the Prussian provinces which were no longer under Napoleon's control. Stein, however, could not obtain cooperation from the German officials, and retired in 1815. He died at Kapenberg, Westphalia, on June 29, 1831.

STEINBOK, a small antelope (*Raphicerus campestris*), numerous in thinly forested country throughout South Africa. Its fecundity and ability to do without water preserve it from extinction even in thickly settled districts, where it grazes with little fear in open daylight, usually alone. Sharpe's Steinbok, a second species, prefers rocky ground. These antelopes are remarkable for lacking false hoofs.

STEINER, EDWARD ALFRED (1866-), American educator and sociologist, was born in Czechoslovakia, Nov. 1, 1866. He was educated at the universities of Heidelberg, Göttingen and Berlin and at Oberlin College. In 1891 he entered the Congregational ministry and occupied various pastorates in Minnesota and Ohio until 1903, when he became professor of applied Christianity at Grinnell College. He is the author of numerous sociological works, including *On the Trail of the Immigrant*, 1906; *The Immigrant Tide*, 1909; *From Alien to Citizen*, 1914; *Old Trails and New Borders*, 1921; *The Eternal Hunger*, 1925, and *The Making of a Great Race*, 1929.

STEINMETZ, CHARLES PROTEUS (1865-1923), American electrical engineer, was born in Breslau, Germany, on Apr. 9, 1865. After studying mathematics, physics and chemistry at Breslau, Zurich and Berlin, he became involved in political difficulties in Germany, and went to America in 1889. He first worked as an engineer in a small factory at Yonkers, N.Y., but after its merger with the General Electric Co., Steinmetz went to Schenectady and in a few years had become a leader in electrical engineering problems in the United States. To him is due the simple method of using imaginary quantities for calculating problems of alternating current, which has found extensive application in telephony. His work on the hysteresis losses in magnets and generators, and

that on the phenomena accompanying lightning and similar discharges has been of fundamental importance in the development of electrical power plants and for high-tension transmission. In 1902 Steinmetz became professor of electrical engineering at Union College, Schenectady, retaining his position as consulting engineer of the General Electric Co.; he wrote a number of text books and took out a large number of patents. He died at Schenectady on Oct. 26, 1923.

STEINSCHNEIDER, MORITZ (1816-1907), Orientalist and bibliographer, born in Prossnitz, Moravia, on March 30, 1816. In his early student days he devoted much time to the study of Oriental languages and their literatures and paid special attention to bibliography. In 1850 he obtained the Ph.D. degree from the University of Leipzig, and nine years later he was made lecturer at the Veitel-Heine Ephraimschen Lehranstalt in Berlin. Subsequently he directed the affairs of the Berlin Jewish school for girls and in 1869 joined the staff of the Royal Library, Berlin. In his literary endeavors he paid special attention to the literature of the Jews in all lands and through which their contribution to civilization is expressed best. His survey of Jewish literature which was published in several languages is the first of its kind, and his catalogues of Jewish books and manuscripts in the great European libraries form an inexhaustible source of information on all phases of Jewish history and literature. His work on Hebrew translations (1893) is the most important if not the largest of his numerous publications which deal with a variety of subjects such as mathematics, medicine, natural history, philology, philosophy, etc. His writings are listed by George A. Kohut in the *Festschrift* published in honor of Steinschneider's 80th birthday (1896). He died in Berlin, January 24, 1907. J. BL.

STELAE, in Greek, blocks of stone, and particularly blocks or pillars set up as memorials or grave-stones. Stelae were used in Egypt. An early stela discovered at Wadi Halfa records the conquest of Nubia by a general of Senwosret, or Sesostri I. On this tablet the king boasts: "I have brought all the lands that are in Nubia under thy feet, O Good God, Lord of life and satisfaction for ever!" There are many Egyptian stelae in the Boulak museum. A stela of the 18th dynasty commemorates a bow factory. In Greece the memorial stela was often a four-sided pillar tapering toward the top and crowned with leaves or flowers of camomile. Some of the Greek memorial stelae have very beautiful figures in low relief. The Way of the Tombs at Athens was adorned with stelae. Later Greek and Roman stelae are generally lower and broader, and are often crowned with a pediment. Many stelae are tomb stones.

STELE, an upright tablet or pillar of stone, used as a boundary marker, a commemorative or funerary monument, or merely as a place on which to carve an inscription. Greek grave steles, such as those found outside the Dipylon Gate at Athens, mostly of the 4th century B.C., are famous both for their emotionally

moving relief sculpture, and for the rich crestings or finials based on the ANTHEMION which topped them. Chinese steles usually have the upright inscribed portion carved with a dragon, and supported on a tortoise.

STELLA, the name given by the British satirist, JONATHAN SWIFT, to Hester Johnson, with whom he was deeply in love and to whom he may have been secretly married, as some critics believe, in 1716. Swift met "Stella" at Sir William Temple's estate, Moor Park, Surrey, when she was a young girl. He supervised much of her education and later invited her to come to Dublin, which she did, living there with a Mrs. Dingley. She died in 1728. Swift's *Journal to Stella*, which was begun in 1710 and finished in 1713, gives pictures of the life and events of the day.



GRECIAN STELE
Berlin Museum

STELLAR EVOLUTION, the term applied to the development of the stars with the passage of time. See COSMOGONY.

STELLAR STATISTICS, that division of astronomy in which observations are no longer treated individually but grouped together and discussed accordingly.

STELLARTON, a town in Pictou Co., Nova Scotia, Canada, on the East River, 105 mi. northeast of Halifax, and 2 mi. southeast of New Glasgow. Depending largely on the Albion coal mines, it is a prosperous mining and manufacturing town, and a junction on the railroad branch to Pictou Landing, a coal shipping port. Pop. 1921, 5,312; 1931, 5,002.

STELLENBOSCH, UNIVERSITY OF, an institution at Stellenbosch, South Africa. It had its beginnings in the formation of the Arts Department of the University of South Africa in 1874. This was chartered in 1881 as Stellenbosch College, the name being changed in 1887 to The Victoria College of Stellenbosch. In 1918 it became the University of Stellenbosch. Instruction is given in arts, law, education, science, theology, music, commerce and agriculture, with practical experimental and extension work in the latter subject conducted at the Elsenburg Experiment Station. The library contains 52,740 volumes. In 1930 the student enrollment was 1,101, and the faculty of 90, inclusive of lecturers, was headed by Chancellor P. J. G. de Vos.

STEM DUCHIES, a term used to designate the five major divisions of Germany during the early middle ages, Saxony, Franconia, Bavaria, Swabia and Lotharingia (Lorraine). Roughly these correspond to certain tribal divisions in Germany. They played an important part in German politics after the break up of the Carolingian empire, and for a time it appeared as though Germany might disintegrate into five separate nations. This separatist tendency was checked, however, by Otto the Great, 936-973, who appointed members of his own family to the duchies

and employed the clergy to counterbalance the power of the dukes. Thereafter the tendency was for the duchies to break up into smaller units.

STEMMING, in mine BLASTING, the filling, or tamping used in a drill hole above an explosive charge. It prevents dissipation of the explosive force out the open hole. Clay and fine sand are the best materials, but in vertical drill holes in wet ground, water may serve as stemming.

STEMS, the organs which hold leaves up to the light. They may be large or small, trees, shrubs or herbs. They also conduct food and water and sometimes support flowers, act as storage organs or substitute for leaves, as in cactus. They generally appear erect, cylindrical and composed of successive internodes and nodes or joints where leaves are produced with buds in their axils. In youth, stems are green and soft in texture, qualities retained by many herbaceous stems, while trees and shrubs become covered with gray, red, white, yellow or brown bark, and are firm and woody. These changes are associated with development of the tissues, recognizable in a section across a stem. The larger number of seed plants show a series of concentric rings of tissue including an outer epidermis, green cortex, a hollow cylinder composed of groups of conducting cells (vascular bundles) separated by non-conducting pith rays, and a central soft pith sometimes disappearing with age. Each vascular bundle is made of two kinds of tube-like cells, food-conducting phloem toward the cortex, and water-conducting xylem or wood toward the pith. In stems that increase in diameter, a layer, cambium, lying between these two adds to each, but most markedly to the wood. Since the yearly increase is ordinarily distinct, the age of perennial stems may be approximated by counting these annual rings. Most perennials also develop resistant outer bark.

This type of arrangement of tissues, characteristic of gymnosperms (pine) and dicotyledons (bean, oak) is contrasted with that of monocotyledons (palm), where there is no sharp definition of cortex and pith. The vascular bundles, of xylem and phloem, appear scattered in an undifferentiated tissue as seen in a cut cornstalk. There is no cambium and hence no increase in diameter due to production of new wood in successive seasons.

N. E. P.

STENCILING, a quick hand-process of painting a decorative design. The stencil consists of a sheet of stiff paper, thin metal, leather or the like, from which the pattern has been cut out with a sharp knife. When the stencil is laid upon the material to be decorated, a broad, rapid stroke of the brush over the whole stencil will apply the color where it is wanted. Sometimes the color is sprayed on from an air brush, first used in the United States in 1908. A multicolored design will require a separate stencil for each color. This craft is appropriate for decorating walls, furniture, curtains, couch and bedspreads and other household articles with conventional designs. It can be practiced in the home with the use of water colors, oil colors or aniline dyes.

One characteristic of stenciled designs is the interruption to the continuity of the pattern, due to the ties required to hold the background together. Unless these are skillfully placed the effect is unpleasant. The Japanese show great dexterity in the use of this art.

Stencil plates were used in England for coloring playing cards even before wood engraving was known, which in turn antedated the art of printing from movable type. Many of the earliest woodcuts were colored by stencil.

STENDAL, a German city in the Prussian province of Saxony, about 65 mi. west of Berlin. It was once capital of the Altmark. One of the most important north German cities in medieval times, it was a Hanseatic city in the 15th century and stood at the head of a group of united cities. Stendal received its first municipal charter in 1160. Among the churches are the late-Gothic cathedral, the foundation of which was laid in 1188, St. Mary's Church, dating from 1400, and the 14th century church of St. James. There are interesting old city gates and fine promenades in place of the old fortifications. It manufactures textiles, iron furniture, agricultural machinery and other articles. Pop. 1925, 29,701.

STENDHAL (1783-1842), pen name of Marie-Henri Beyle, French author, who was born in Grenoble, southeastern France, Jan. 23, 1783. As a child he developed an abnormal sensibility and a tendency to morbid introspection in trying to escape from his narrow, provincial environment. He was known as a brilliant student. In 1790 Stendhal went to Paris, where he stayed with the Daru family, distant relatives. With the younger Darus he went to Italy as a soldier in 1800, being present at the Battle of Marengo; henceforth Napoleon was his god and Italy his adopted country. He pursued various occupations and adventures in Paris, Marseilles and elsewhere till 1814, when he returned to Italy. He was a conspicuous figure in Milan, and his close association with such eminent authors and radical politicians as Manzoni, Monti and Silvio Pellico made him politically suspect to the Austrian police; in 1821 Stendhal returned perforce to Paris. In the Paris salons he was renowned for his wit. From 1831-41 he served as French Consul at the small Italian seaport, Civit  Vecchia, a boresome experience to a man of Stendhal's energy and intellect. He returned to Paris and died there of apoplexy, Mar. 22, 1842.

Stendhal's early writings were of a miscellaneous nature, including several biographies, *Histoire de la Peinture en Italie*, *Racine et Shakespeare*, *Rome, Naples et Florence*, *Promenades dans Rome*, *M moires d'un Touriste*, *Essai sur l'Amour* and a romantic novel, *Armance*. His fame rests chiefly on two of his four novels, *Le Rouge et le Noir*, published in 1830, and *La Chartreuse de Parme*, 1839. The first is a psychological novel dealing with the life of a brilliant, ambitious and unscrupulous young man, Julien Sorel. The *Chartreuse de Parme*, with its highly romantic plot and exciting picture of Italian

court intrigue, was Stendhal's first popular work. His later writings include a fourth novel, *Lucien Leuwen*, *Souvenirs d'Egotisme* and *Journal d'Italie*, all published posthumously.

Stendhal has become a figure of increasing importance in French literature, and his appeal to the modern reader is undoubtedly stronger than it was ever to his contemporaries. A close analyst of emotions, thoughts and motives, he was one of the earliest and most successful of the French psychological novelists, and his influence in this field has been powerful. His characters are so completely motivated, the springs of their action so wholly revealed, that some critics have found them unreal and called them mere puppets. More than this, Stendhal was a master story teller, and his fertile imagination could take flights beyond even a Dumas *p re*. He was both a realist and a romanticist, and in fact Stendhal defies rigid classification. His style is in the best French tradition, fastidious, clear, sensitive to every demand. *See also FRENCH LITERATURE*.

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STENO, NICOLAS (1631-87), Danish physician and theologian, who wrote much on anatomical and geological matters. He was born in Copenhagen in 1631, later moving to Florence. He returned to Copenhagen to accept the Chair of Anatomy at that university. He had become a Catholic while in Italy, and in 1677 he was named Bishop of Heliopolis. His treatise *Concerning Solids Naturally Contained Within Solids* showed the importance of fossils and discussed the deposition of sedimentary rocks, and the effect of running water in shaping the earth's surface. He also discovered that the angle between the same faces in similar crystals is constant. Steno died in 1687. *See also GEOLOGY; CRYSTALLOGRAPHY; MINERALOGY*.

STENODE, the trade name of a particular type of SUPERHETERODYNE radio receiver ordinarily built with an OSCILLATOR, first DETECTOR, fixed-FREQUENCY amplifier, second detector and audio amplifier. Its distinguishing characteristic is that a circuit using a QUARTZ crystal is built into one of the coupling circuits in the fixed-frequency amplifier to make the receiver ultra-sharp in tuning. A loss in higher tones resulting from this arrangement is compensated by the audio amplifier, which is constructed in such a manner as to amplify the high tones more than the low ones. *See also RADIO RECEIVER*.

STENTOR, a legendary Greek herald in the Trojan war, described by Homer as the "brazen-voiced Stentor." His voice was supposed to be as loud as the combined voices of 50 ordinary men. The adjective stentorian is derived from Stentor.

STENTOR, the name of a genus of one-celled animals belonging to the Infusoria. There are eight species, all of which live in fresh water. They have elongate green, blue or colorless bodies, which are very contractile, as they contain numerous muscle-like bands (*myonemes*). Large cilia are found about the mouth,

and smaller ones are distributed over the body. Often stentors attach themselves to water plants by their smaller ends.

As the stentor is large for a one-celled animal, some species being $1/25$ in. long, it is often used for experiments in regeneration. If it be cut into pieces, any part having a portion of the nucleus will grow into a new individual. See also INFUSORIA; PROTOZOA.

STEPHEN, ST., one of the first deacons of the Church at Jerusalem, and the first Christian martyr. After he had discomfited the Jews in a debate, he was accused of blasphemy, and was stoned to death outside the city. His feast is celebrated on Dec. 26.

STEPHEN, name of 10 popes. St. Stephen I, 254-257, was allegedly a martyr. Stephen II died in 752 un consecrated, and thus is usually not counted. Stephen II, 754-757, sought aid from the Frankish King Pepin, whom he crowned and from whom he received territory, the beginning of the Papal State. Stephen III, 768-772, also sought aid from Frankish kings. Stephen IV, 816-817, crowned Emperor Louis the Pious in Rheims. Stephen V, 885-891, crowned Duke Wido of Spoleto Emperor. Stephen VI, 896-897, had the body of his predecessor thrown in the Tiber and was himself strangled. Stephen VII, 929-931, was a tool of Theodora and Marozia. Stephen VIII was pope 939-942. Stephen IX, 1057-58, was under Hildebrand's influence.

STEPHEN (1097-1154), King of England, son of Henry, Count of Blois, and grandson of William the Conqueror, was born in 1097. After the death of Henry I he usurped the throne of England in 1135, notwithstanding the prior claims of Matilda, the daughter of Henry. The 19 years of Stephen's reign were filled with the unrest and strife attending his disputed succession. He created many new earldoms in order to win supporters, and was forced to resort to oppressive measures of taxation to finance his military expeditions against Matilda's defenders. Broken by age and misfortune and by the death of his only son, he finally consented to legalize the succession of Matilda's son, Henry, to the throne. Stephen died in 1154.

STEPHEN, DUSHAN (1331-55), King of Serbia. After succeeding to the throne of a kingdom already large and powerful, Stephen dreamed of uniting the whole Balkan peninsula and eventually assuming the imperial crown at Constantinople. An able general and a shrewd diplomat, he conquered western Macedonia and seized a large portion of Albania. He defeated the Greeks, the King of Bosnia, the King of Hungary and in 1346 had himself crowned Emperor and Autocrat of the Serbians and Romans. After his conquests he attempted to consolidate his empire and fashioned an extensive code of laws on the Byzantine model. The Pope urged him to undertake a crusade against the Turks; so in 1355 he occupied Thrace and advanced on Constantinople, only to die suddenly when the city was almost within his grasp. His empire disintegrated rapidly after his death. See SERBIA.

STEPHEN, SIR LESLIE (1832-1904), English writer and editor, was born at London Nov. 28, 1832. He was educated at King's College, London, and at Cambridge. In 1863 he visited America, and did much to improve English relations with the North. In 1868 he repeated his visit, bringing his wife, who was Thackeray's daughter. With George Smith he established the *Pall Mall Gazette* in 1865, and edited the *Cornhill Magazine* from 1871-82. He then became editor of the *Dictionary of National Biography*, contributing to it 378 articles. Among his other writings are *The Playgrounds of Europe*, an account of his mountain climbing experiences; *Free Thinking and Plain Speaking* and *English Utilitarians*, probably his most important book. He died at London, Feb. 22, 1904.

STEPHENS, ALEXANDER HAMILTON (1812-83), American public official and Confederate leader, was born Feb. 11, 1812, near Crawfordville, Wilkes Co., Ga. He entered political life in 1836 when he was elected to the Georgia Legislature and served until 1841. The following year he was elected to the House of Representatives, where he was a prominent Whig and later, with the disintegration of that party, a Democrat. He opposed secession, but following his state, in 1861 helped to form the Confederacy, of which he was Vice-President, 1862-65. In 1865 he headed the Confederate commission to the Hampton Roads peace conference. On the fall of the Confederacy, Stephens was arrested and imprisoned several months at Ft. Warren, in Boston harbor. Although he was elected to the United States Senate in 1866, because of the reconstruction controversy he was not seated. He was then reelected to the House of Representatives, and served from 1873 to 1882. He was Governor of Georgia in 1882-83. Stephens was the author of the best expression of the Southern position, *A Constitutional View of the Late War Between the States*. In it he tried to prove by an application of cool, unadorned logic to a compact succession of historical facts, that the secession of the southern states had been legally valid. He died at Atlanta, Ga., Mar. 4, 1883.

STEPHENS, JAMES (1882-), Irish poet and writer, was born in Dublin in 1882. He received little formal education and worked as a clerk in a lawyer's office while he wrote the first of his delicate, fantastic prose. *The Crock of Gold*, his first book, appeared in 1912. It was followed by *Here Are Ladies*, short stories, 1914, *Reincarnation*, 1918, *Deirdre*, 1923, *In the Land of Youth*, 1924, *Collected Poems*, 1926, *Etched in Moonlight*, 1928, and *Theme and Variations*, poems, 1930.

STEPHENSON, GEORGE (1781-1848), English engineer and inventor, born near Wylain, June 9, 1781. After working with engines for several years he began to experiment on them. In 1815, he took out a patent on an engine which utilized the escaping steam to increase its speed. In 1821, he became construction engineer for the Stockton and Darlington Railway, and five years later entered the service of the

new Liverpool and Manchester Railway, inaugurating great improvements. Subsequently, Stephenson served as principal engineer on many important railways in England and as consultant engineer on railways in Belgium and Spain. He died at Tapton House, Chesterfield, Aug. 12, 1848.

STEPHENSON, ROBERT (1803-59), English engineer, only son of GEORGE STEPHENSON, born at Willington Quay, Oct. 16, 1803. He received a scientific education at Newcastle and Edinburgh. After engineering work in South America he took charge of his father's locomotive factory at Newcastle in 1827, having direction of the construction of the *Rocket*. Later he improved railway signaling methods and specialized in the construction of railway bridges, developing the tubular type. He died at London, Oct. 12, 1859.

STEPPE, the Tatar name for vast treeless plains stretching from the River Dnieper, in southeast Russia, across all southern Siberia. Physiographers apply the term also to somewhat similar regions elsewhere, as the Argentine pampas.

The Russian steppes, dry and barren for the greater part of the year, grade through salt steppe into true desert. During the short growing season intervening between a rigorous winter and severe drought, the steppe herbage freshens, to be cured to standing hay as the moisture is exhausted. The fertile "black earth" steppe, like that of the Volga, has long been largely under tillage; and despite the periodic failure of the rains, the Soviet government is laying down immense areas of virgin steppe in wheat and other crops. Enormous stretches, especially in Siberia, are used only as ranges for half-wild cattle and horses. See PAMPA.

STEREOPTICON, an optical instrument for the projection of images on a screen from small positive transparent plates which are termed lantern slides. The fundamental parts of the stereopticon are the source of illumination, a condensing system, slide carrier and an objective, together with shields to prevent stray light from reaching the screen. The source of light is commonly an electric arc (see ARC LAMP) or a specially designed INCANDESCENT LAMP. The condenser system may be a MIRROR or LENS system, or a combination of the two, and serves to project a strong beam of light through the slide which is placed in a carrier adapted for ready changing. The slide and the screen are at conjugate points with reference to the projection lens by which the enlarged image is formed. See also MAGIC LANTERN. I. C. G.

STEREOSCOPE, a binocular instrument by which two pictures of the same object may be viewed as one which stands out in relief. The stereoscopic perception of depth which obtains when an object is directly viewed arises because the two eyes see the object from two different viewpoints. When looking at a single photograph with both eyes, the two eyes see the same picture and the stereoscopic depth perception is lost. The stereoscopic picture consists of two views which differ in exactly the same manner as the two

views of an object seen by the two eyes. The stereoscope permits these two views to be seen by the two eyes and fused into a single picture in which depth perception is clearly evident. The optical parts of the more usual type of stereoscope are two PRISMS, one before each eye. The bases of the prisms are turned outward and they enable the two images to be optically superposed without altering the natural convergence of the eye. I. C. G.

STEREOSPHERE, the inner part of the rocky envelope, or LITHOSPHERE, which surrounds the earth's metallic core, or barysphere. It extends from the surface of the core to the inside surface of the asthenosphere, the stereosphere shell thus having an inside radius of about 2,200 miles and a thickness of 1,000 miles. It is subject to great pressure, from 3,000,000 to 23,000,000 lbs. per square inch, and probably has a temperature of about 12,000° Cent. Pressure keeps the material rigid and prevents its melting. The stereosphere receives heat from the core; this heat it conducts out to the asthenosphere. See also GEOLOGY; GEOPHYSICS; MAGMA.

STEREOTYPING, a process for the rapid duplication of forms. The form to be reproduced must be locked in a special chase for the making of the *papier maché* matrix. The material for this matrix is called a flong, and is made of successive layers of tissue paper built up on a thick sheet of unsized paper, with a special paste. This is placed on the form and covered with a blanket. The old process was to beat the flong with a stiff brush, moulding it into the face of the form; matrix-rolling machines now perform this operation much more quickly. The matrix is dried in contact with the form under pressure on a steam table. When ready, the matrix is placed in the casting box, which may be either flat or curved, and the cast made by pouring or pumping in the melted metal. The speed of casting depends on the speed of the cooling process which may be hastened by water circulation. When trimmed and shaved, the plate is ready for the press. A recent development is a special flong capable of reproducing halftones in comparatively fine screen. Chromium plating is also used to produce a hard, durable surface. E. W. P.

STERILITY, a term meaning inability to procreate. It is estimated that about 10% of all married couples are sterile. There are numerous causes of sterility. (1) In about one-third of the cases the male partner is directly responsible for it, because of physical impotence. (2) In about another one-third the female partner is at fault because of an abnormal development of the generative organs or other factors. (3) In the remaining third, the husband is indirectly responsible because of an infection he transmits to the wife, which infection in turn prevents pregnancy.

In the first group referred to, sterility may be due to some congenital defect in the male, or an affliction acquired later in life. The most common cause of sterility in the male is GONORRHEA, but mumps and other diseases may also seriously interfere. In the second group the responsible factors may be absence

of part or all the organs of reproduction, marked underdevelopment of these organs, tumors and obstructions. Likewise general bodily disturbances, such as those due to abnormalities in the glands of internal secretion, marked obesity, diabetes and other illnesses, may be the cause of infertility. In the third group the disease which usually produces sterility when transmitted from man to woman is gonorrhea. It is responsible for many cases of one-child marriage because after the birth of the first baby there is a return of the gonorrheal infection which leads to sterility.

Occasionally both partners are apparently normal in every way and yet conception does not take place. It is assumed that either the spermatozoa or ova are not healthy and even if a union of the two does take place, it is shortlived. Rarely, a sterile couple separate, each remarrying and each procreating children. Sometimes chronic alcoholism, lead poisoning and other conditions result in sterility in both sexes. Sterility can be produced by contraceptives, operation and other methods.

J. P. G.

STERILITY IN SEED PLANTS. Several well-defined types of sterility develop or operate during the critical stages of sexual reproduction in flowering plants which interfere with, or even entirely prevent, seed and fruit production. When the individual plant is inherently unable to function in any relation in the processes of sexual reproduction, as in cases of abortion of essential organs, there is *absolute sterility*. But plants inherently able to function either as a seed parent or as a pollen parent, or as both, are often placed under conditions which prevent such functioning and there is a condition of *relative sterility* or of *para-sterility*. Such a plant is in reality unfruitful rather than inherently sterile.

A rather well-defined type of relative sterility is the *non-blooming* condition. It is a general law of plant development, well exemplified by the habits of the sweet potato, that plants will thrive vegetatively under environmental conditions that do not admit of flowering. In fact, the flowering habits of all plants are hereditary adaptations to length of daylight, periods of vegetative growth, temperature, and supply and storage of food and when the natural requirements are not met they may fail to produce flowers and hence be fruitless.

When plants flower profusely the perfection and sexual potency of the essential organs are important factors in reproduction. There may be *sterility of doubleness* in which pistils or stamens, or both, are aborted or transformed into petal-like structures. Various grades or degrees of doubleness exist in many horticultural plants cultivated for their flowers, such as the roses, dahlias, chrysanthemums and peonies. Abortion of spores and gametes in pistils and stamens, a type of absolute sterility, often results from *hybridity* and from *polyploidy*. The two groups of chromosomes (*see FERTILIZATION*) derived from the two parents live in harmony throughout the somatic life of the hybrid only to disintegrate during the more intri-

cate processes of spore formation. *Sterility of intersexualism* results in abortion of spores, gametes, or of entire organs, and differs from sterility of hybridity in being, usually, one-sided, producing male-sterility or female-sterility as variants from hermaphrodites. Male-sterile plants in various of the fruit crops that have been developed as clones, for example, the Brighton grape, the J. H. Hale peach, and various pistillate strawberries, require proper cross-pollination before fruit is produced.

Several types of relative sterility develop in connection with morphological and physiological adaptations which restrict self-fertilization and certain intragroup cross-fertilizations. Structural adaptations for cross-pollination reach a climax in the group reciprocations of dimorphism and trimorphism. The climax development of dichogamy also makes reciprocation in pollination necessary for fruitfulness and there is not only self-sterility but intra-group sterility. Without insects to effect proper pollination, many plants will be fruitless and unless reciprocating individuals are growing together insects acting with vigor are unable to effect proper pollination.

In the intricate physiological processes of fertilization in many hemaphrodite plants there is relative sterility from *self-* and *cross-incompatibility*. This type of sterility operates with striking effect in various fruit crops grown as clones, as in apples, pears, plums, and sweet cherries. The individuals of a clone derived from a fully self-incompatible plant are intra-incompatible. The interplanting in an orchard of two self-incompatible and cross-incompatible clones as the Bing and the Napoleon sweet cherries, or the Bartlett and the Seckel pears also results in an unfruitful orchard. In such plants proper interplanting of cross-compatible clones which bloom at the same time and the operation of agents effecting cross-pollination are essential in successful orchard management. Incompatibilities operate in many plants grown only from seed as cabbages, radishes, clovers, petunias, tobaccos, chicory and rye, but in these a population is composed of different seedlings and there is chance for cross-pollinations that are compatible. The incompatibilities become noticeable in these plants when line breeding is attempted.

After fertilization occurs there is in various plants much *embryo abortion* which may exercise selective death of embryos or be complete for all embryos. In seedless fruits there is sterility in respect to sexual reproduction, but there is fruit formation. With certain seedless fruits, however, viable seeds may be obtained by proper pollination.

In apogamy, sporophyte budding, and parthenogenesis there is in reality sexual sterility in spite of the abundance of viable seeds that may be produced, for the embryos are merely buds produced internally. There is a substitution of vegetative reproduction for sexual reproduction in the processes of seed formation.

Thus types of sterility, absolute or relative, operate in flowering plants in the formation of flowers, in the

development of spores and gametes and of pistils and stamens, in the operation of the adaptations for pollination, in the physiological reaction of fertilization, in the organization of the new embryo in seeds, and in the substitutions for sexual reproduction.

There has been a keen interest and considerable speculation among horticulturists and botanists regarding the nature and origin of sterilities in plants that are propagated vegetatively. Sweet potatoes are cultivated for their fleshy roots, Irish potatoes for their tubers, sugar-cane for the sugary sap, seedless fruits for their fruits, plants with double flowers for flowers, etc. The types of sterility in these plants also appear in annuals grown exclusively from seeds. It is obvious that when a plant has any type of absolute sterility or the non-blooming habit it can only continue in existence and be multiplied when there is some means of vegetative propagation. There is no conclusive evidence that the sterilities or the degeneration of sex organs in these plants arise as a direct result of vegetative propagation or become more acute because of it.

Many plants that are more or less sterile in sexual reproduction are valuable as cultivated plants because they yield products other than seeds or fruits that depend on seeds for development. There are many plants grown exclusively for their seeds or seeded fruits which exhibit various types of relative sterility according to their demands for pollination, fertilization, and fruit production. A. B. S.

STERILIZATION, the destruction of all bacteria, saprophytic as well as parasitic, whether in the vegetative or spore forms. This may be accomplished by heat, dry or moist, or by chemical means. The process is to be distinguished from disinfection (*see* DISINFECTANT) which includes the destruction of disease bacteria only. In hospital practice the most common practice for sterilization is subjecting the product to be sterilized (gowns, instruments, cultures, etc.) to an atmosphere of steam at 20 pounds pressure (*autoclaving*). *See also* ANTISEPTICS. P. N. L.

STERKRADE, a former German city in the Prussian Rhine province, about 20 mi. north of Düsseldorf. It merged in 1929 with the cities Oberhausen and Osterfeld into the municipality of Oberhausen. The western portion of the city united with Duisburg-Hamborn. Pop. 1925, 50,757.

STERLING, GEORGE (1869-1926), American poet, was born in Sag Harbor, Me., Dec. 1, 1869. He was educated in private schools and at St. Charles College, Ellicott City, Md., and about 1895 went west and settled in California. He produced a considerable quantity of poetry of which the most characteristic was published in *The Testimony of the Suns*, *The Wine of Wizardry* and *The House of Orchids*. His verse was mostly of the flamboyant type, expressed in extravagant, colorful phrases, but showing a fine poetic insight. *Lilith* and *Rosamund*, dramatic poems, and *Sails and Mirages* are among his later works. Sterling died in San Francisco, Calif., Nov. 18, 1926.

STERLING, a term applied to the standard quality of silver used in British coinage; also used to denote

the gold SOVEREIGN. Sterling comprises 92.5 parts of silver and 7.5 parts of copper. Formerly, sterling was the name of an English silver coin equal to a PENNY and of a similar Scottish coin. Because of the long-lived high standing of British coinage, lasting until England discarded the gold standard, sterling has come to denote anything of superior quality, as, sterling character.

STERLING, a city in northeastern Colorado, county seat of Logan Co., situated on the South Platte River, 122 mi. northeast of Denver, served by bus lines and two railroads. The city is a trading center for a large irrigated area, producing chiefly sugar beets and grain. The principal manufacture is beet-sugar. Sterling was settled in 1878 and incorporated in 1884. Pop. 1920, 6,415; 1930, 7,195.

STERLING, a city in Whiteside Co., northwestern Illinois, situated on Rock River, opposite the city of Rock Falls. Two railroads and bus lines serve the city. There is an airport. The chief crop of the region is corn. Hardware, farming implements and condensed milk are the leading manufactures. The retail trade in 1929 amounted to \$6,604,692. Northeast of Sterling is White Pines Forest State Park. The city was founded in 1834 and incorporated in 1857. Pop. 1920, 8,182; 1930, 10,012.

STERNE, LAURENCE (1713-68), English author, was born Nov. 24, 1713, in Clonmel, Ireland, where the regiment of his father, Ensign Roger Sterne, was then stationed. His childhood was that of a vagabond, for he was compelled to follow his father's regiment from place to place in Ireland. At 10 he was sent to school at Halifax, Yorkshire, and subsequently to Cambridge. Sterne was graduated in 1736, and two years later became the curate of Sutton, a village near York. At 28 he married Elizabeth Lumley, and through a friend of his wife's obtained also the curacy of Stillingham, a nearby village. He lived like a country gentleman, hunting, fishing, reading, dining; he was gay and expensive in his habits, and was locally famed for his wit. For some 20 years he wrote little except his sermons, which were often of a peculiar cast of thinking. Then in 1760 he astounded the world with the first two volumes of his *Life and Opinions of Tristram Shandy, Gent.*, and overnight became the most celebrated author in England. (*See* TRISTRAM SHANDY.) Although written under the pen name of "Yorick," the book was quickly recognized as Sterne's, and when the new author arrived in London he was feasted and lionized as the greatest novelist of the day. He was appointed to the more remunerative curacy of Coxwold and otherwise honored, and meanwhile the fashionable world literally begged him for more of *Tristram*. Sterne's delicate health was soon ruined by various excesses, and he lived henceforth mainly in London or on the Continent. He died, badly in debt, in London, Mar. 18, 1768.

Tristram Shandy, which appeared in nine volumes from 1760-67, is not a novel in the strict sense, and indeed the book defies classification. It has been

compared with the great work of RABELAIS. In its analysis of thought and feeling it owes something to the method of SAMUEL RICHARDSON, but in point of style *Tristram* is unique. It is erudite, brilliant in its wit and often bawdy in its humor, touchingly delicate and uncanny in its construction. Its technique foreshadowed the later "school of consciousness" writers in its minute detail. Although often criticized as immoral, the book ranks as a masterpiece of English prose. Sterne's other works include several volumes of sermons, the unfinished *Sentimental Journey Through France and Italy*, 1867, and *Letters from Yorick to Eliza*, posthumously published in 1775. See also ENGLISH LITERATURE.

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STERNE, MAURICE (1878-), American painter, was born at Libau, Russia, July 13, 1878, and came to New York City in childhood. After studying in New York and traveling extensively in Europe, the artist made a special study of the people of Bali, one of the East Indian Islands. Sterne is represented in the Carnegie Institute, Pittsburgh; Rhode Island School of Design; Metropolitan Museum, New York; Boston Museum; Detroit Museum; Los Angeles Museum; Kaiser Friedrich Museum, Berlin; Cologne Museum, Germany; and Tate Gallery, London.

STERNER, ALBERT EDWARD (1863-), American painter and illustrator, was born in London, England, Mar. 8, 1863, of American parents. He studied in Birmingham, England, and in Paris under Boulanger, Lefebvre and Gérôme. He opened a studio in New York in 1885, and illustrated for *Life*, *St. Nicholas* and *Harper's*. Later he was an instructor in the Art Students' League and in the New York School of Applied Design for Women. He illustrated *Prue and I*, by George W. Curtis, and works of Edgar Allan Poe and Mrs. Humphrey Ward. Sterner's paintings include *Portrait of Martin Birnbaum*, in the Carnegie Institute, Pittsburgh; *The Blue Stocking*, Metropolitan Museum, New York; *The Grey Cape*, Toronto Museum; *Nude*, Brooklyn Museum; and *Amour Mort*, South Kensington Museum, London.

STESICHORUS (c. 640-555 B.C.), Greek lyric poet, was born probably at Himera, Sicily, about 640 B.C. He remodeled the ODE by adding the epode to the strophe and antistrophe.

His *Destruction of Troy* contains the story of the wanderings of AENEAS. Stesichorus also wrote the story of the siege of Thebes and several poems relating the exploits of Heracles. Only fragments of his poems are extant. Stesichorus died at Catania in 555 B.C.

STETHOSCOPE, an instrument employed in auscultation, or the examination of the body by the sense of hearing. The stethoscope was invented by Laënnec, as a means of intensifying tone vibrations. Stethoscopes have been made in varied forms and out of varied materials. They consisted originally of a hollow stem of hard rubber or metal, with an enlarged funnel-shaped tip at one end, and an ear plate

with a hole in the middle fastened perpendicularly at the other. At the present time flexible stethoscopes are usually employed. They consist of a funnel-shaped end branching out into two rubber tubes. The rubber tubes are in turn attached to metal tubes on the end of which are ear pieces. In using the stethoscope, the funnel-shaped end is carefully applied so that it makes an air-tight connection with the skin.

STETTIN, a city of northeastern Germany and capital of the Prussian province of Pomerania, situated on the Oder River about 30 mi. from the Baltic. It is well laid out with parked promenades and fine squares. St. Peter's Church, founded in 1124, was the first Christian church in Pomerania; St. James's is noted for its size. There are a few other old buildings and many imposing new ones. Trade and industry are of importance. There are large ship-building plants, iron works, machine factories, a great number of other manufactures, sea-coast and interior shipping. The trade includes a comprehensive list of commodities, as Stettin is Germany's largest port on the Baltic Sea. It was an old Slavic settlement, became a city in 1243, a member of the Hansa in 1360 and became Prussian in 1720. Pop. 1925, 254,466.

STEBEN, FREDERICK WILLIAM AUGUST HENRY FERDINAND, BARON VON (1730-94), German-American soldier, was born Nov. 15, 1730, at Magdeburg, Prussia, a descendant of an ancient noble family. Receiving his scholastic education at the Jesuit colleges at Neisse and Breslau, he early began his military training in actual warfare. He entered the Prussian army in 1747 and fought with such distinction in the Seven Years' War that Frederick the Great made him his aide-de-camp. At the end of the war he was for ten years grand marshal of the Prince Hohenzollern-Hechingen and then a short time at the court of Baden. In Dec., 1777, he went to America, offering to drill the raw recruits of the Colonial army. His services were accepted and in May, 1778, he was appointed inspector general in the Colonial army with the rank of major general. To the troops of Washington Von Steuben imparted his Prussian military training and discipline which told in the subsequent fighting, and in 1780, he was sent to train the troops in the South, being commander in Virginia until replaced by Lafayette. He was at the siege of Yorktown. The gratitude of the Americans was expressed by grants of land, a pension and other honors. After the war he retired to his New York estate at Steubenville, Oneida County, where he died Nov. 28, 1794.

STEBENVILLE, a city of northeastern Ohio, the county seat of Jefferson Co., situated on the Ohio River, about 43 mi. southwest of Pittsburgh and 23 mi. north of Wheeling. The Pennsylvania and Wheeling and Lake Erie railroads, steamboat and bus lines and the Beverly Hills airport serve the city. Steubenville is built on a plain, surrounded by high hills which are rich in oil, gas, coal, clay and building stone. The manufactures include steel and steel products, paper, wood pulp and pottery, their ap-

proximate value in 1929 amounting to \$37,000,000; the same year the retail trade amounted to \$24,111,675. Steubenville was one of the first towns to use steam for manufacturing purposes. Edwin M. Stanton, Secretary of State under Lincoln, made his home here.

The city is located on the site of Ft. Steuben, which was erected during the Revolution and named for Gen. Baron von Steuben, the German drillmaster of the American troops. During the Civil War Steubenville was an important post of the underground railroad. The town was planned in 1797 and in 1851 received a city charter. Pop. 1920, 28,508; 1930, 35,422.

STEVENS, EDWIN AUGUSTUS (1795-1868), American shipbuilder and philanthropist, was born at Hoboken, N. J., in 1795. He inherited large railroad interests, which he extensively developed. He helped design a swift, ironclad vessel for the government, but the ship was never completed, although more than ten years work and a million dollars had been spent on it. Stevens built another ship, the *Naugatuck*, for the government and this saw service during the Civil War. In 1867 he founded STEVENS INSTITUTE OF TECHNOLOGY at Hoboken, N. J. Stevens died in 1868.

STEVENS, HENRY (1819-86), American bibliographer, was born at Barnet, Vt., Aug. 24, 1819, and educated at Yale. In 1845 he went to London, where he remained the greater part of his life as a collector of Americana for the British Museum and various American libraries, and as a purchasing agent for the Smithsonian Institute, the Library of Congress and other institutions. He made a special collection of Franklin documents and published valuable bibliographical matter, including *Catalogue of American Books in the Library of the British Museum* and *The Bibles in the Caxton Exhibition*. Stevens died in Hampstead, London, Feb. 28, 1886.

STEVENS, JOHN (1749-1838), American inventor and engineer, was born at New York City, in 1749. He was graduated at Columbia in 1767, beginning a law practice in 1771. In 1776 he was made captain in the Revolutionary Army, and during 1777-82 was treasurer of New Jersey. Stevens began studying the possibilities of steam-driven vessels in 1787, and in 1804 was the first to use screw propulsion in navigation. To protect the growing number of his marine and rail inventions, he petitioned Congress to enact the basic legislation of the present-day patent code of the United States. He launched the *Phoenix* in 1807, a few days after Fulton successfully demonstrated the *Clermont*. In 1811 he began operation of the first steam-ferry in history, connecting Hoboken with New York City. He died at Hoboken, N.J., Mar. 6, 1838.

STEVENS, ROBERT LIVINGSTON (1787-1856), American engineer, born at New York City, Oct. 18, 1787, son of JOHN STEVENS. He adopted the profession of his celebrated father, and the Stevens percussion shell was the first of his long series of inventions and improvements relating to

ship design and marine engine construction. In 1830 Stevens was elected president of the Camden and Amboy Railroad, and soon afterward designed the types of spike, rail, tie and tract ballast which came into general use throughout the world. He drew the plans for the yacht *America*, first of the American entrants in the AMERICA'S CUP races. Stevens died at Hoboken, N.J., Apr. 20, 1856.

STEVENS, THADDEUS (1792-1868), American statesman, was born at Danville, Vt., Apr. 4, 1792. After attendance at Peacham Academy and the University of Vermont in Burlington, he went to Dartmouth College from which he graduated in 1814. The same year he moved to York, Pa., where he taught in an academy and studied law. He was admitted to the bar in 1816 and began practice at Gettysburg. As an anti-Mason, he was a member of the state house of representatives 1833-35, 1837 and 1841. In 1835 he acted directly opposite to the instructions of his district by opposing in the legislature a bill to abolish the free school system of the state which had been created the year previous. The bill was defeated and Stevens was regarded as the savior of free schools in the state. He was a delegate to the state constitutional convention in 1838 and the same year was appointed a canal commissioner.

Stevens moved to Lancaster, Pa., in 1842, where he continued the practice of law and in 1848 as a Whig was elected to the national House of Representatives serving from 1849-53. In Congress, whenever the opportunity offered itself, he assailed the institution of slavery as thoroughly vicious. He retired to his law practice from 1853-59, participating in many of the leading cases in the state. He worked strenuously for the success of the new Republican party in 1856 and was elected to the 36th Congress which met Mar. 4, 1859. He served in the House from then until his death. He was soon recognized as a Republican leader and in the 57th Congress as chairman of the committee of ways and means, he virtually dictated the business of the House.

Violently opposed to slavery and convinced that the successful prosecution of the Civil War by the North would mean the extinction of the institution, Stevens throughout the war urged legislation for emancipation. As chairman of the committee on Pacific roads he framed most of the bills providing for the construction of the Union Pacific and Central Pacific railways. After the assassination of Lincoln, the proposed reconstruction policy of Andrew Jackson was most unacceptable to Stevens and he introduced a bill that no representatives or senators from the former Confederate states should be admitted to either house until a joint committee on reconstruction, consisting of six senators and nine representatives, had reported a plan for their admission. The bill was passed and the committee with Stevens as chairman was largely responsible for the harshness and severity of the subsequent reconstruction policy of the South. The opposition of Johnson to their plans aroused the implacable hatred of Stevens who introduced a bill Feb. 2, 1868

for the impeachment of the President. Although the House appointed Stevens chairman of the managers to conduct the impeachment proceedings, ill health prevented him from publicly directing the trial. He died at Washington, D.C., Aug. 11, 1868.

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STEVENS INSTITUTE OF TECHNOLOGY, an institution for men founded at Hoboken, N.J., in 1867, by Edwin Augustus Stevens. It was opened as a college of engineering in Sept. 1871, being the first college in the United States to be devoted to mechanical engineering and to give the degree of M.E. The institution offers only the four-year engineering course, and concentrates on the instruction of electrical, civil, chemical, hydraulic and mechanical engineering. Well-equipped foundries, shops and laboratories are maintained. The institute had productive funds in 1931 amounting to \$3,400,000. The library contained 22,000 volumes. In 1931-32 the student enrollment was 525, and the faculty of 59 was headed by Pres. Harvey N. Davis.

STEVENSON, ADLAI EWING (1835-1914), 23rd Vice-President of the United States, was born in Christian Co., Ky., Oct. 23, 1835. He moved with his parents to Bloomington, Ill., in 1852. He attended the Illinois Wesleyan University at Bloomington and Centre College, Danville, Ky. In 1858 he was admitted to the bar and began to practice in Woodford Co., Ill., where he was master in chancery, 1860-64. In 1864 he was Democratic candidate for presidential elector. He served as a Democrat in the national House of Representatives, 1875-77 and 1879-81, and in 1885 was appointed First Assistant Postmaster-General. In 1892, at the Democratic convention which renominated Cleveland, Stevenson was named for Vice-President. At the expiration of his term, Stevenson was appointed to the commission sent to Europe to seek adoption of international bimetallism. He was the unsuccessful candidate for the Democratic nomination for Vice-President in 1900 and unsuccessful Democratic candidate for Governor of Illinois in 1908. He died at Chicago, Ill., June 14, 1914.

STEVENSON, BURTON EGBERT (1872-), American author, was born at Chillicothe, O., Nov. 9, 1872. He attended Princeton University, 1890-93, and became editor of the Chillicothe *Daily News* in 1894, and the Chillicothe *Daily Advertiser* in 1898. From 1899-1926, he was librarian of the Chillicothe Public Library, and in the latter year became director of the American Library at Paris, France. He edited many works, including *A Child's Guide to American Biography*, *Home Book of Verse*, 1912, and *Home Book of Modern Verse*, 1925. Stevenson's own works include *A Soldier of Virginia*, *The Heritage*, *The Young Train-Dispatcher*, *Little Comrade*, and *The Coast of Enchantment*, 1926.

STEVENSON, ROBERT (1772-1850), Scottish civil engineer, born at Glasgow, June 8, 1772. In 1791 he joined his stepfather, Thomas Smith, in the construction of the Little Cumbrae lighthouse, and

in 1799 he followed Smith as engineer of the Board of Northern Lighthouses. During the period 1797-1843 he was responsible for the design and construction of 18 lighthouses. His inventions include flashing lights, bell signals and other lighthouse apparatus. Stevenson died at Edinburgh, July 12, 1850.

STEVENSON, ROBERT LOUIS (1850-94), British poet and writer, was born in Edinburgh, Scotland, Nov. 13, 1850, and was educated at Edinburgh University. From infancy he was very frail, and severe illnesses during childhood weakened his physique. He studied to be an engineer but, lacking physical strength, turned to the law. Then ill-health drove him to France where he began his famous essays, after training himself in literary style. Illness sent him in search of health and strength to the south of England, France, the United States, on a wander year in the South Seas, and finally to Samoa, where he made his home during the last 4 years of his life. But charming books always resulted from Stevenson's travels and new habitations. Among his most famous novels are *Dr. Jekyll and Mr. Hyde*, *Treasure Island*, *Kidnapped* and *The Master of Ballantrae*. His ballads and verses have been collected in several volumes, while among his essays, which include *Virginibus Puerisque*, *Across the Plains* and *Travels with a Donkey*, are some of the noblest examples in the English language of this form of literature. The charm, romantic quality and fascination of Stevenson's character are reflected in his writings. He died at Vailima, Samoa, Dec. 3, 1894.

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STEVENS POINT, a city in central Wisconsin, the county seat of Portage Co., situated on the Wisconsin River about 125 mi. northwest of Milwaukee. Two railroads serve the city; there is also an airport. Stevens Point is in an agricultural district; dairy products and potatoes are especially plentiful. In 1929 the output of the various local manufactures amounted approximately to \$6,000,000; the retail trade reached \$7,709,048. The site was settled about 1846 and chartered as a city in 1858. It is the seat of a state teachers' college. Pop. 1920, 11,371; 1930, 13,623.

STEWART, ALEXANDER TURNEY (1803-76), American merchant, was born at Lisburn, near Belfast, Ireland, on Oct. 12, 1803. He was educated at Trinity College, Dublin, and emigrated to the United States in 1823, settling in New York. Two years later he opened a small dry goods store. In 1848 at the junction of Chambers Street and Broadway he built a new store which was later destined to be used as a wholesale department of yet another store which he opened in 1862 at Broadway and 10th Street. The new store became immensely successful, and branches were formed in Paris, Lyons, Manchester and Belfast. In 1869 Stewart was appointed Secretary of the Treasury by President Grant, but the appointment was not ratified owing to the law excluding from office all those engaged in the impor-

tation of merchandise. Grant demanded the repeal of this law and Stewart, on his side, offered to place his store under trustees and to devote the profits to charity while in office, but these suggestions did not prove acceptable. Stewart was a philanthropist of wide sympathies. In 1846 he sent shiploads of provisions to the famine-stricken population of Ireland and during the France-Prussian War he gave generously to the French sufferers. He also established Garden City, at Hempstead Plain, L.I., with a moderately priced dwelling for working men. He died in New York on Apr. 10, 1876.

STEYR, city in Upper Austria situated on a tongue of land formed by the Steyr and Enns rivers. It is the center of the iron and steel industry of Upper Austria and also manufactures motors and motor vehicles, bicycles, machines, cutlery and other wares. It has a large tourist trade, as it is a picturesque old town with quaint houses and narrow streets and a castle built in the latter part of the ninth century. It became prominent in the Middle Ages, but was later devastated by wars. Pop. 1923, 22,111.

STIBNITE, the chief ORE of antimony, is a metallic-looking mineral of steel gray color, but may be tarnished black or iridescent. Stibnite usually occurs in prism-shaped crystals of the ORTHORHOMBIC SYSTEM, with striated or furrowed sides. In composition it is antimony sulphide.

The chief source of antimony is from the deposits in China. There the stibnite is found in cracks and fissures in a shattered QUARTZITE. In Bolivia it occurs in quartz veins. Common associates of stibnite are SPHALERITE, GALENA, CINNABAR, BARITE and QUARTZ. Deposits are known in California and Nevada, but are mined only when antimony brings a high price. See also ORE DEPOSITS.

STICK INSECT, an orthopterous insect of the family *Phasmidae*, called also "walking stick." It is a greenish-gray color; has an elongate, wingless body; very long, slender legs and antennæ. The oddly-shaped eggs, each encased in a capsule, are dropped on the ground or in the trees, one at a time. Stick insects feed on the leaves of plants, but rarely occur in sufficient numbers to do damage. *Diaperomera femorata* is a North American species which feeds particularly upon walnut trees.

STICKLEBACK, a small, spiny fish belonging to a family (*Gasterosteidae*) found in northern waters. It is found in fresh and salty water and in the temperate sections of the North American, Asiatic, and European coasts. The stickleback has a slender, compressed, scaleless body, more elongate in marine forms, and protected on the side by scutes resembling mail. Pointed spines take the place of the ventral and first dorsal fins. The mouth is filled with sharp teeth, used in attacking the fins of other fish and in voraciously devouring young fry.

In the spring, the male chooses a territory where he builds a nest of leaves, sticks, and sand, held together with cement-like thread which he secretes by a special gland. The females are induced to enter

the small, barrel-shaped structure singly, and deposit their eggs in layers. Each lot of eggs is fertilized separately by the male after the female's departure through the other opening in the nest. During the 10 to 18 day hatching period, the eggs are guarded by the male.

The three-spined stickleback (*Gasterosteus aculeatus*), reaching a length of about 4 in., and the ten spined stickleback (*Pungitius pungitius*), about 2 in. long, are widely distributed throughout the inland waters frequented by these fish. A fifteen-spined, sea stickleback attains a length of 7 in. and is one of the largest of the group.

STIGMARIA, the generic name of certain peculiar branching fossils common in the Coal Measures, which resemble tree-roots. They were first identified as underground, root-bearing stems of a giant Lycopod, SIGILLARIA. Later it appeared that an allied genus, LEPIDODENDRON, possessed roots so like that the fossils were indistinguishable. The surface of *Stigmara* is pitted by former rootlets. The branches fork regularly into two equal parts.

STIGMATA, an ecclesiastical term signifying the five wounds inflicted on the hands, feet and side of Christ. In Catholic records, some of which are precisely documented, there are more than 300 instances in which the *stigmata* is recorded as appearing on the bodies of devout persons, the most famous case being that of St. FRANCIS OF ASSISI. On Apr. 24, 1868, Louise Lateau, a peasant girl at Bois-de-Haine, Hainault, was, according to medical investigations, so stigmatized. A contemporary case which is attracting world-wide attention is Therese Neumann at Konnersreuth, Bavaria.

STIKINE, one of the tribes of the Tlingit of the Koluschan linguistic stock, an important American Indian group. The Stikine live near the mouth of the river of the same name in southeastern Alaska.

STIKINE RIVER, a river of southeastern Alaska. From its source in British Columbia it flows generally westward in a series of canyons through the Coast range and directly across the panhandle of Alaska to reach the Pacific Ocean. The city of Wrangell is located near its mouth. One of its important tributaries is the Stikine glacier which is 4 mi. broad along the river and 80 mi. long.

STILICHO, FLAVIUS (d. 408), Roman general. Son of a Vandal cavalry officer in the army of the Emperor Valens, Stilicho early distinguished himself in the profession of arms. Theodosius I made him general-in-chief of the Roman armies. On the death of Theodosius in 395 Stilicho was made guardian of the young Honorius in the west. That year he marched against the Visigoths in Greece, but was ordered by Arcadius to return to the west. In 396 he cornered Alaric and his Visigoths in the mountains, but they escaped. Stilicho again returned to the west to quell a revolt of the Moor, Gildo, in Africa. He became consul in 400, and repulsed the invasions of Alaric and Radagaisus. Suspected of plotting against the imperial throne, Stilicho was executed in 408.

STILL, ANDREW TAYLOR (1828-1917), founder of OSTEOPATHY, was born at Jonesboro, Va., Aug. 6, 1828. He received his higher education at Holston College, Newmarket, Tenn. During the Civil War, Still served as a surgeon and major in the 21st Kansas Volunteers. In 1874 he began practicing the principles of osteopathy he had formulated. The first American School of Osteopathy was founded by him at Kirksville, Mo., in 1892. Among his works are *The Philosophy of Osteopathy*, 1897, *Mechanical Principles*, 1902, and *Practice and Research*, 1910. Still died at Kirksville, Mo., Dec. 12, 1917.

STILL, an apparatus wherein a liquid is vaporized or distilled (whence the name). The usual form of still consists of a closed container fitted with a liquor inlet and vapor outlet and with a source of heat. The heat may be supplied by direct fire, or by a condensing vapor, such as steam. In some cases, this heat may be supplied by blowing steam directly into the liquid. The vapors from the still may pass directly to a condenser, and there be converted into a liquid by a cooling process, or they may pass into the bottom of a fractionating column. See FRACTIONATION; DISTILLATION.

W. L. McC.

STILL LIFE PAINTING IN AMERICA. The high excellence of still life painting in America is largely due to JOHN LA FARGE, who was a factor in revolutionizing the art of flower painting in the West by infusing into it the spirit of the East, which combined the rhythmic beauty of the growing flower with superb decorative value and gorgeous color. La Farge stands with Fantin-Latour as one of the greatest interpreters of modern flower painting. Independently, he not only sent direct for Japanese prints, which in 1860 were just making their appearance in the West, but through scientific experiments of the refraction of light on atmosphere in producing color, which later developed with him into Impressionism, produced a series of flower studies of great freshness and elusive poetic quality. At that time flower painting was a despised art in America, and even in Europe there was slight incentive to emulate the sumptuous and richly ornate Dutch flower painting, with its photographic literalness. True to his adherence to Western art traditions, La Farge made no attempt to adapt Japanese design or characteristics, but was quick to discern that the Orient knew infinitely more than the West of the character and spirit of flowers and their decorative expressiveness. In painting them he combined this Oriental feeling with subtle effects of transmitted light or luminous atmospheric effects. Not only had the flower painting of La Farge a widespread influence, but he was able to impart his knowledge directly to two gifted pupils as well as to his immediate descendants; his son, Bancel La Farge and his wife Mabel Hooper, and grandchildren, Thomas Sergeant, Oliver, Grant, Christopher and Henry.

Maria Oakley Dewing stands next to her master as the great American flower painter. She has devoted herself to the subject, and combines a feeling

for the spirit of the flower with botanic understanding. Wilton Lockwood, pupil and assistant of La Farge, gives to his flower painting the same soundness, subtlety and imaginative insight. Other flower painters of high worth are J. Alden Weir, Abbot Thayer, Laura Coombs Hill, George and Julia Dillon and Walter Dawson. Howard Cushing paints Japanese flower arrangements in the modernistic spirit as does Henry Dearth, who builds up a fantasy of Oriental still life properties and living flowers to produce an exotic design of color and symbolism.

As La Farge stood for the Eastern spirit of still life painting as transfused through the French school, so William Chase stood for the Western, as developed through the Dutch and the German. A product of Munich, he superimposed upon masterly drawing and faultless finish, or technique as technique, an individual verve and vivacity. These latter qualities made him a great influence in inspiring American students under his instruction with the possibilities of artistic treatment in tone, color and texture, and of cleverness and dexterity of brushwork. He was a master of purely objective art for whom the sheen of a copper surface had the same interest as the human expression. His painting of fish is sometimes regarded as his greatest achievement. Artists who have carried on the Dutch tradition are Edmund Tarbell, Joseph de Camp, William Pacton, Henry Rittenberg, Charles Hawthorne, Emil Carlsen, Hugh Breckenridge and Henry Keller. Artists who have made reputations in other branches of art and are also skilled still life painters are Jonas Lie, Irving Couse, Gari Melchers, Childe Hassam, Eugene Speicher, Maurice Fromkes, Frank Benson and Walter Gay, noted for his painting of French interiors of the 17th and 18th centuries.

STILLWATER, a city in eastern central Minnesota, the county seat of Washington Co., situated on the St. Croix River, 18 mi. northeast of St. Paul. Bus lines, river craft, and three railroads afford transportation. The city is attractively located in Friendly Valley, famous for its fishing. Farm crops are grown in the vicinity. Lumber and steel products and shoes are the chief manufactures. This region was the scene of battles between Sioux and Chippewa Indians. Stillwater was incorporated in 1854. The state penitentiary is located here. Pop. 1920, 7,735; 1930, 7,173.

STILLWATER, city and county seat of Payne Co., north central Oklahoma, situated 63 mi. southeast of Enid. It is served by the Santa Fé Railroad. The city is a shipping center for live stock, dairy products, poultry and cotton. Stillwater has flour mills and cotton gins. It is the seat of the State Agricultural and Mechanical College and the agricultural experiment station. Pop. 1920, 4,701; 1930, 7,016.

STILT, a genus (*Himantopus*) of shore birds closely allied to the plovers, with very long legs and long slender necks and bills. A single species, the blacknecked stilt (*H. mexicanus*), occurs in North America, ranging from tropical America northward to the Gulf coast, the Great Basin and locally in the Mississippi valley. It is about 15 in. long, the male

STIMSON—STINNES

having the upper parts glossy greenish-black, and the underparts and facial markings white; the female is similar but brownish slate colored above. Moving in flocks it frequents salt marshes and brackish or fresh water ponds, wading for its food of small shell fish, insects and various other forms of aquatic life. It breeds in wet meadows, building for a nest a scanty platform of straw and grass, and laying three or four spotted grayish eggs.

STIMSON, FREDERICK JESUP (1855-), American lawyer and author, was born at Dedham, Mass., July 20, 1855. He began law practice in Boston, Mass., and served as assistant attorney-general of Massachusetts in 1884-85, and as general counsel to the U.S. Industrial Commission in 1898-1902. He held the chair of comparative legislation at Harvard in 1903-14, was ambassador to Argentina during 1914-21, and served as special ambassador to Brazil in 1919. His works of law include *American Statute Law*, *Stimson's Law Glossary*, *Labor in Its Relation to Law*, *The American Constitution*, *The American Constitution as it Protects Private Rights* and *The Western Way—American Democracy*. He also wrote fiction and essays, some under the pen-name "J. S. of Dale." Among these are *Guerndale*, *Mrs. Knollys and Other Stories*, *Pirate Gold* and *The Light of Provence*. A biographical work, *My United States*, appeared in 1931.

STIMSON, HENRY LEWIS (1867-), American statesman and lawyer, was born at New York City, Sept. 21, 1867. He was educated at Phillips-Andover Academy, Yale University (A.B. 1888) and Harvard Law School (LL.D. 1890). Admitted to the New York bar in 1891, he was associated with Elihu Root's law firm, of which two years later he became a partner, the firm name being changed to Root, Howard, Winthrop and Stimson. His reputation as a brilliant, industrious lawyer led to his appointment by President T. ROOSEVELT as U.S. attorney for the southern district of New York, 1906-09. Stimson cooperated with Roosevelt in his efforts to curb the evil practices of big corporations. He compelled E. H. HARRIMAN to testify as to his railroad policies before an investigatory board, and also he exposed and stopped the illicit conduct in New York City of the Sugar Trust which included tampering with the scales in order to show underweight, and the bribery of customs officials. In 1910, he was defeated as the Republican candidate for governor of New York. He was Secretary of War in President W. H. TAFT's cabinet, May 1911 to March, 1913. When the U.S. entered the World War, Stimson went to France with the American Expeditionary Force as Lieutenant-colonel of the 305th Field Artillery. He was in several engagements and in 1918 was promoted to colonel of the 31st Field Artillery. After the war he resumed his law practice in New York City. In 1927, as President C. COOLIDGE's special representative in Nicaragua, he arranged for an election to be supervised by the U.S. which placated the two principal warring factions. He served as governor-general of

the Philippine Islands, 1927-29, and was appointed Secretary of State, Mar. 1929 by President H. HOOVER. He was one of the U.S. delegates to the London Naval Conference in 1930. In the Far Eastern crisis of 1931-32 Stimson energetically endeavored to maintain peace by the exertion of diplomatic pressure upon the nations involved. He was the chairman of the American delegation to the Disarmament Conference at Geneva in 1932.

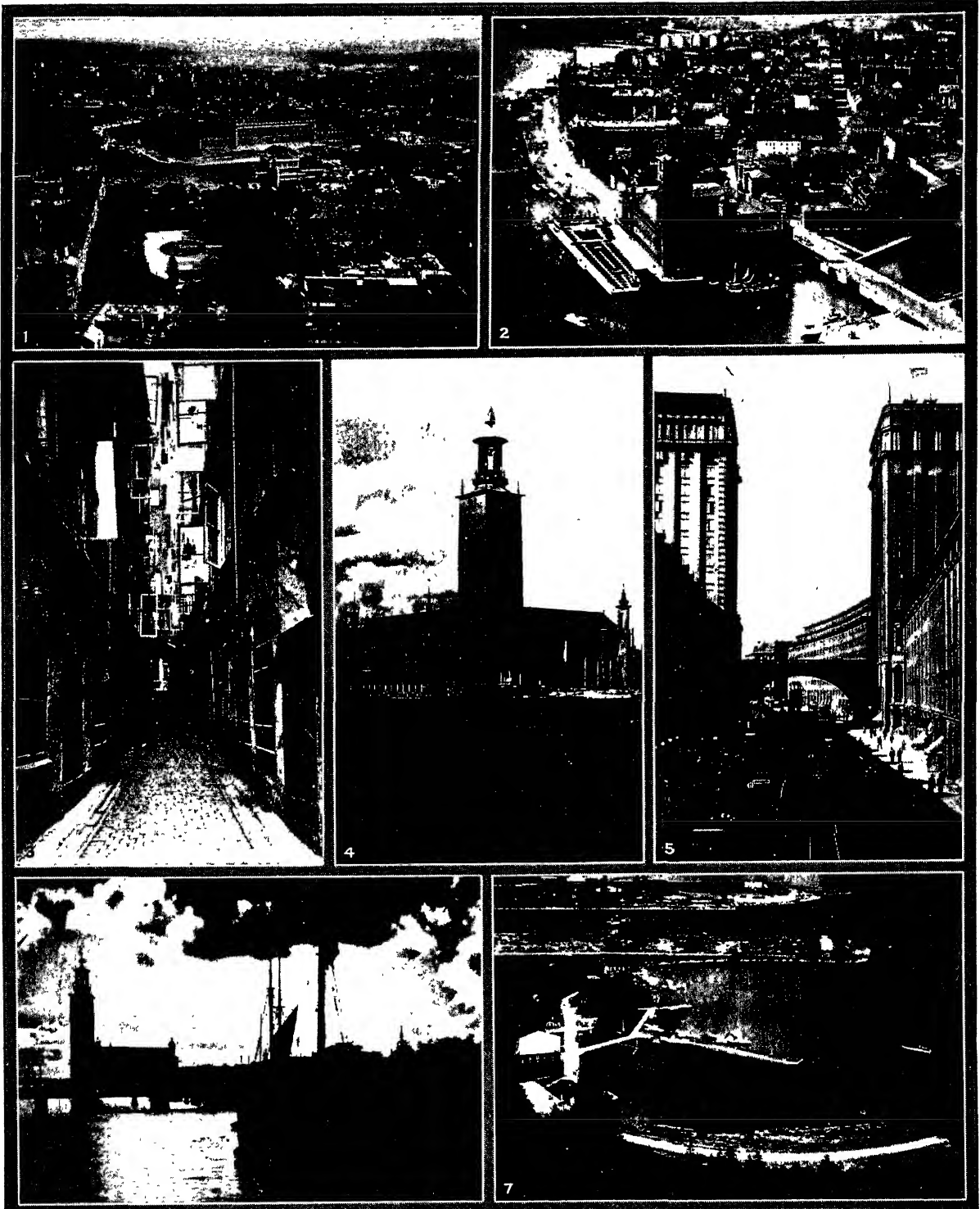
STINGAREE, a name given to various rays, more commonly known as sting rays, which have long whiplike tails provided at the base with a very sharp, toothed spine capable of inflicting serious wounds. See **STING RAY**.

STING RAY, called also stingaree, the name for a family (*Dasyatidae*) of rays having usually slender, whiplike tails provided at the base with a very sharp, toothed spine capable of inflicting dangerous, jagged wounds. They are mostly of large size with the body much flattened and skate-like, very broad pectoral fins, which are united about the snout, and smooth or roughish skin. Sting rays are found in nearly all seas, lying flat on sandy bottoms and feeding upon crabs and shellfish. They are ovoviviparous, hatching their eggs within the body. Among the best known species are the northern sting ray, stingaree or clam-cracker (*Dasyatis centrourus*), rarely over 6 ft. but sometimes 12 ft. in length, found on both sides of the Atlantic ranging on the American coast from Maine to Cape Hatteras, and the similar Pacific sting ray (*D. dipterurus*), abundant about San Diego Bay.

STINKWOOD, a name applied to various trees with wood of an unpleasant odor, especially to the south African stinkwood (*Ocotea bullata*), a large tree of the laurel family which yields valuable timber. The hackberry stinkwood (*Celtis Kraussiana*), a tree of the elm family also native to south Africa, likewise produces useful timber. In the eastern and southern United States the sour gum or pepperidge (*Nyssa sylvatica*) and the yellow buckthorn (*Rhamnus caroliniana*) are sometimes called stinkwood.

STINNES, HUGO (1870-1924), German industrialist and financier, was born at Mulheim, Feb. 12, 1870. After his education as a mining engineer, he was in business with his grandfather until 1892 when he organized his own company. In 1914 he had amassed a fortune exceeding \$10,000,000, consisting of vast coal and ore properties, mills, ocean and river steamships, newspapers, hotels, and farms. At one time his holdings in the Rhine and Elbe districts were valued at \$615,000,000, and in the period immediately before the World War he was the most powerful industrialist on the continent. After the Armistice he increased his activities, and contemplated uniting German industries into one vast trust, to accelerate the payment of reparations. Stinnes was elected to the Reichstag in 1920 as a member of the German People's Party, and nearly became chancellor. He died at Berlin Apr. 10, 1924. Business rivals forced an investigation of his properties soon after his death, and caused liquidation of the enormous business.

STOCKHOLM



COURTESY SWEDISH STATE RAILWAYS

THE BUSY MODERN CITY OF STOCKHOLM, SWEDEN

1. Airplane view of Stockholm, capital of Sweden. 2. Aerial view of the City Hall. 3. A narrow passage on Staden, the old quarter. 4. The new City Hall, called one of the finest embodiments of modern architecture. 5. Skyscrapers flank

the Kungsgatan, one of the busiest thoroughfares in the modern district. 6. City Hall, designed by Ragnar Östberg, bordering on Lake Mälaren which leads to the Baltic Sea. 7. Seaplane base at Stockholm.

STIPPLE, a form of engraving executed entirely in dots, resulting in a soft, grained effect. On a copperplate "grounded" as for ETCHING, the design is dotted in with a curved point, exposing the metal, which is then bitten with acid. The open or close grouping of dots of varying fineness produces smooth tone gradations suitable for portrait work, for which stipple was in vogue in England and America during the later 18th and the 19th century. Stippling was often reinforced by etched or engraved lines, or combined with AQUATINT. A finely toothed wheel, called a ROULETTE, was sometimes used to lay in the dots.

STIRLING, a royal burgh and county town of Stirlingshire, Scotland, situated on the Forth, about 37 mi. northwest of Edinburgh. Stirling is the geographical center of Scottish history and its castle played an important part in the history of Scottish sovereigns until the crowns were united in 1603. Mary Queen of Scots and James VI were both crowned in the parish church. To-day, as an industrial and agricultural center, Stirling has handsome modern buildings and, to remind of its past, fragments of its ancient walls, and the "auld brig" which, in 1570, was the scene of the last execution in Scotland of a Catholic prelate. Although the harbor of Stirling is not large, some shipping is carried on. There are considerable manufactures of woollens, furniture, and agricultural implements. Pop. 1921, 21,345; 1931, 22,503.

STIRLING NUMBERS corresponding to a number n may be defined as the sums of the products of the first n integers 1, 2, 3, . . . , n , taken as factors 1, 2, . . . , p at a time, with or without repetitions. James Stirling (1692-1770) made use of them (1730) in expressing polynomials as series of factorials. Since then, as coefficients in various expansions, they have found application in many branches of analysis. Their importance is shown by the number of tables of their values prepared by various mathematicians. They may be easily computed by the help of the relationship ${}_{i+1}U_j = (j+1){}_iU_j + {}_iU_{j-1}$, where ${}_mU_n$ is the sum of the products of the first m integers taken as factors n at a time with repetitions.

STOCK, FREDERICK AUGUST (1872-), American composer and orchestral conductor, was born at Julich, Germany, Nov. 11, 1872. He received his musical education at Cologne, where he studied violin with Japha, and composition with Zollner, Wullner, and HUMPERDINCK. He served as a violinist in the Cologne Municipal Orchestra during 1891-95, and in the latter year came to the United States to play the viola in the Chicago Orchestra. After the death of THEODORE THOMAS in 1905, he became director of the latter's orchestra, the nucleus of the Chicago Symphony Orchestra. He became a naturalized citizen of the United States in 1919. Stock's compositions include a symphony in C-minor, a set of variations on an original theme, a tone poem for large orchestra, concerto for violin and orchestra, two overtures, and a number of string quartets and songs.

STOCK, in geology; see Boss.

STOCK (*Mathiola incana*), in botany, an erect felty-hairy perennial of the mustard family, called also gillyflower. It is a native of southern Europe extensively cultivated in numerous forms as a garden ornamental. The stiff slightly woody stems grow 1 to 2 ft. high bearing narrowly oblong leaves and numerous showy flowers, often double and of a wide range of colors. The ten weeks stock (var. *annua*) is an early blooming annual grown from seed. Various allied species are called stock, especially the evening stock (*M. bicornis*) with very fragrant purple flowers opening at evening and closed by day.

STOCK BROKER, an agent who executes orders to purchase or sell securities for some one other than himself. Brokers make their livelihood out of commissions paid to them by the purchasers they represent but cannot make a profit out of any difference between buying and selling prices. Rules of different exchanges vary. In Paris the official brokerage organization forbids its members on THE BOURSE to act as dealers. The New York Stock Exchange allows its members to act as either broker or dealer so long as they do not attempt to occupy both positions in the same transaction. The London Stock Exchange divides its members into brokers and dealers, or jobbers, and each member must be consistently one or the other. See STOCK JOBBER; STOCK EXCHANGE.

STOCK EXCHANGE, an important part of the machinery of CREDIT and banking, providing an organized market for the buying and selling of STOCKS, BONDS, rights and certain other instruments of finance. A stock exchange has many functions, its principle ones being as follows: 1. To provide a ready market for sound and salable stocks and bonds by bringing buyer and seller together. 2. To increase the safety of dealings in securities of great value by preventing irregular or fraudulent methods of dealing and to prevent the issue of forged or fraudulent securities. 3. To aid in the promotion of new enterprises and to bring capital and projected business ventures together. 4. To balance actual values with market values and to stabilize prices, which in an unorganized market would be entirely without stability. 5. To furnish a business barometer since quoted prices have a direct relation to business conditions.

There are more than 20 stock exchanges in the United States including the New York Stock Exchange and the New York Curb Exchange in New York City. Canada has three. In all there are more than 200 stock exchanges in the world. In Russia the authorities have reconstituted the Moscow Exchange and several others. The largest American stock exchange is the New York Stock Exchange, followed by the New York Curb Exchange. The London Stock Exchange, although closely rivalled by the New York Stock Exchange in size and activity, is unparalleled in the international scope of its listings and dealings. The Parquet, on the Paris BOURSE, is a great market for French government and company securities and also for other foreign government loans. The chief market for German securities is the Berlin

Bourse which has had a major part in Germany's rise and recovery within the past half-century. Italian securities are marketed chiefly at Milan, Belgian securities in Brussels and Vienna is the market for Eastern European issues.

The New York Stock Exchange was organized on May 17, 1792, as an outdoor market and occupied its first indoor quarters in 1827. In 1867 the electric stock ticker was adopted to speed up quotations and in 1878 telephones were first installed. From 1879 to 1929 membership was limited to 1,100. In the latter year each member was given an additional quarter-membership, increasing the total membership to 1,375. The first recorded high and low prices for seats were \$7,500 and \$3,000 respectively in 1869. In 1929 a seat was sold for \$625,000. Late in 1930 the par value of 1,607 bond issues listed on the New York Stock Exchange was \$50,027,129,653 with a market value of \$48,715,222,900. On the same day the stock listings consisted of 853 issues, comprising 1,284,052,185 shares with a total market value of \$60,143,183,105. During the panic of 1929, on Oct. 29, shares of stock to the number of 16,400,000 were dealt in. *See also* BOURSE.

STOCKHOLM, the capital of Sweden, the country's largest city, and one of its most important seaports. In a situation of singular beauty near the east coast, where Lake Mälaren has its outlet to the sea, Stockholm has been planned and built to take every advantage of its waterside location. Large ocean-going vessels may be moored in the city, opposite the Royal Palace, and busy wharves line important, dignified and well-cared-for thoroughfares. In import trade the first port of Sweden, Stockholm is exceeded in exports by GÖTEBORG and equaled by MALMÖ. It is first among Swedish industrial centers, and has widely varied manufactures. The old Swedish handicrafts, especially weaving, are also practised. Founded in the 13th century, Stockholm repeatedly has been devastated by fire and the present metropolis is largely modern. The oldest quarter occupies the small island of Gamle-Staden, the island between the bridges, where the first stronghold was established; here are the fine 18th-century Royal Palace, the House of the Nobility, the church where the kings of Sweden are buried, and the Storkyrka, 17th century, which is one of the oldest churches in Stockholm, although largely rebuilt in the 18th century. The city includes several islands, but the principal business and residence sections are on the mainland. The famous town hall of Stockholm, completed in 1922, is one of the most beautiful of the world's modern buildings. Other imposing recent structures are the concert hall, law courts, and Royal Dramatic Theater. The city has a number of parks and squares, and its vistas are magnificent. The island of Djurgården contains the fine Northern Museum, 1907, and the Skansen, a remarkable open-air museum of Swedish life, 1891. Pop. 1931, 502,203.

STOCKHOLM BLOOD BATH. Christian II of Denmark, 1513-23, in attempting to secure his posi-

tion in Sweden, issued on Sept. 5, 1520, a proclamation absolving his erstwhile opponents from responsibility for the revolt that had taken place, and was crowned King of Sweden on Nov. 4. The coronation was followed by a massacre, however. Members of the Swedish Council, prominent nobles and burghers were called to an assembly on the seventh. The occasion was turned into a wholesale arrest of some four score leading personages who were tried by an impromptu court, pronounced guilty of heresy or treason, and executed on Nov. 7 and following days. Instead of delivering a death blow at the Swedish national party, the "Blood Bath" contributed to the outbreak in Sweden-Finland of renewed resistance to Denmark, under the leadership of Gustavus Vasa, King of Sweden, 1523-60, which led to a final dissolution of the union established in 1389.

STOCK JOBBER, a trader in securities who deals for himself alone and depends upon profits resulting from the buying and selling of such securities. The London Stock Exchange (*see* STOCK EXCHANGE) is conducted on the jobber system. There are two classes of members, jobbers and brokers, each class distinct from the other and prohibited from functioning outside its own rôle by the exchange rules. The jobber may not deal with the public but acts as intermediary between brokers. He receives no commission but makes his compensation on the difference between the buying and selling price of the securities he handles. The London broker may not deal with a fellow broker but must obtain both bid and offer figures from the jobber, from whom he buys or sells according to his desire. *See* STOCK BROKER.

STOCKPORT, a municipal and county borough, partly in Lancashire, and partly in Cheshire, England, situated upon a hilly site at the junction of the Tame and Mersey rivers, 183 mi. northwest of London. Once a small Roman military station, a 12th century castle is also known to have existed until at least 1327. To-day the town, extended to more level ground above the river, is of largely modern construction, having many bridges, public buildings, schools and churches. It is something of a railway and commercial center and includes in its industries, motor and electrical engineering and the manufacture of cotton and felt, leather and foodstuffs. Pop. 1921, 123,309; est. 1929, 125,505.

STOCK RIGHTS, the privilege sometimes given a stockholder to subscribe to additional stock of the same or another class, or to bonds of the same company, or to convert bonds into stock at a certain price usually below the market. When a corporation finds it desirable to obtain additional capital, it is customary to give the stockholders preference over the general public in offering such stock. In case a company with 1,000,000 shares of common stock decided to issue 100,000 additional shares, the holder of 100 shares would obtain the right to buy 10 new shares. This privilege, attached to one share of stock held, of subscribing to the new, regardless of the ratio which the original stock bears to the new,

is called one right. Such rights are transferable and if the holder of the old stock does not wish to exercise his privilege to purchase new stock he may sell and transfer it. The privilege to buy the new offering of stock must be exercised within a limited period at the end of which the right to subscribe to the new stock expires and the original stock is said to be ex-rights. Where the period during which rights may be exercised is a sufficiently long one, certificates are prepared and the rights are listed on the **Stock Exchange**.

STOCKS. In America the word stock refers to shares in the capital stock of a corporation. In Great Britain stock is usually synonymous with **DEBENTURE BONDS**, whether of a civil or corporate nature. In that country government or municipal loans are referred to as stock. Throughout the world there are organized markets (*see* **Stock Exchange**) for the purchase and sale of stocks and other securities. In the United States nearly all large corporations are stock companies. Stocks may be divided into many groups, chief among which are industrial, railroad, mining and public utilities. Practically every corporate endeavor in industry and transportation is represented by stocks which are regularly dealt in in an appropriate market. Every corporation must issue **COMMON STOCK** which is the fundamental basis of corporate existence. It may also issue **PREFERRED STOCK**. Common stock represents ownership in the corporation and is not a debt of that corporation. Its value may not be sued for, nor does a common stockholder have any claim upon the corporation's assets until after all other obligations have been paid.

Trading in stocks and bonds constitutes one of the major financial activities of our times. Trading in stocks may be conducted in many ways. The investor buys stocks and holds them in order to profit by dividends and by increased value of the stock due to growth of earning power. The speculator (*see* **SPECULATION**) on the other hand buys stocks, either outright or on margin, to hold temporarily for a rise or sells them short (*see* **SHORT SELLING**) in the belief that prices will fall. **MARGIN TRADING** constitutes a large proportion of the business of the **Stock Exchange**. Stocks traded in on the organized exchanges form an important proportion of all the stocks issued in the United States; but there are many unlisted stocks, some of which are closely held and rarely find their way into the open market and others that are dealt in on secondary markets or are entirely unlisted. *See also* **REGISTERED STOCK**; **No-PAR STOCK**; **AUTHORIZED STOCK**.

STOCK-TAKING. *See* **INVENTORY**.

STOCKTON, FRANCIS RICHARD (1834-1902), American novelist, who generally wrote under the name, Frank R. Stockton, was born in Philadelphia, Pa., Apr. 5, 1834. He received a high school education, and went into journalism. He was on the editorial staff of *Hearth and Home*, *The Century Magazine* and *St. Nicholas*. In 1880 he gave up editorial work to devote himself to independent writing.

Stockton is best known for his short stories included in *The Lady or the Tiger?*, 1884, *The Christmas Wreck*, 1886, and *The Bee Man of Orn*, 1887. The novel, *Rudder Grange*, 1879, was popular, as were two novelettes, including *The Casting Away of Mrs. Lecks and Mrs. Aleshine*, 1886, and his stories for children. Stockton died in Washington, D.C., Apr. 20, 1902.

STOCKTON, an inland port city in central California, county seat of San Joaquin Co., situated at the head of the tidewater on the Stockton Channel, three mi. east of the navigable San Joaquin River, 48 mi. southeast of Sacramento. Steamers, bus and truck lines and six railroads serve the city. Near by are two airports. The rich San Joaquin Valley yields crops of potatoes, vegetables, alfalfa and fruit, especially Tokay grapes. The manufactures are numerous, including shipping cases, harvesters and canned food products. The factory output, 1929, was worth \$25,118,469. In 1929 the retail business amounted to \$36,541,077. Stockton is the seat of the College of the Pacific. The Hudson's Bay Co. established an outpost four mi. from here in 1828; in 1844 the first settlement was founded; the city was incorporated in 1850. Soon after the discovery of gold Stockton became a leading port with ships in her harbor from all parts of the world. Pop. 1920, 40,296; 1930, 47,963.

STOCKTON-ON-TEES, a town and port of Durham, England, on the Tees, about 5 mi. above its mouth, and 236 mi. northwest of London. The town belonged to the Bishops of Durham and developed around their castle which, founded between 1182 and 1214, was dismantled after the Civil Wars. The public buildings of Stockton are largely modern. The first railway passenger line was opened between Darlington and Stockton. The port's quays admit vessels of 22 ft. draft, and there are shipbuilding yards, steel works and foundries. Pop. 1921, 64,126; 1931, 67,724.

STOCKYARDS, depots designed to receive live stock shipped from the farms to be slaughtered and dressed in packing houses or sold for further fattening. They are located at railroad centers and near packing plants. One of the oldest and largest is the Union Stock Yards in Chicago. Others are situated at Omaha, Kansas City, St. Paul and St. Louis. Yards are arranged with pens for feeding and holding stock and alleyways in which buyers ride while they make their selections. *See also* **SLAUGHTER HOUSE**; **PACKING PLANTS**.

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STODDARD, JOHN LAWSON (1850-1931), American lecturer, traveler and writer, was born at Brookline, Mass., Apr. 24, 1850. He graduated from Williams College and studied theology at Yale. He became, however, a traveler and lecturer, and for 20 years gave his *Stoddard Lectures* in the United States with great success. Among his publications are *Red Letter Days Abroad*, 1884; *Glimpses of the World*;

The Stoddard Library, 1910, and *Christ and the Critics*, 1923-24. Stoddard retired from the lecture platform in 1897. He died in Italy, June 5, 1931.

STOIC, an ethical school founded by ZENO (340-265 B.C.), and taking its name from the Greek word for porch. After its founder's suicide, the school continued under the direction of Cleanthes. He was succeeded by Chrysippus (d. 206 B.C.). Stoicism also had considerable influence in the Roman world, where it was best represented by SENECA, EPICETUS and the emperor MARCUS AURELIUS (161-180). Roman Stoicism took on more of a religious character, while its representatives among the Greeks had also developed a theory of knowledge. It is for its ethical teachings, however, that the school is best known.

The Stoic wise man was he who could reach the state of *apathy*, when the pleasures and troubles of the world no longer disturbed him. He led a life according to reason and by so doing kept himself in tune with nature, for nature was but a manifestation of reason. "Virtue for virtue's sake" is a typical Stoic maxim.

STOICHIOMETRY, that part of physical science which is concerned with quantitative relations. Thus, in chemistry, the chemical formulae and chemical equations are said to indicate the stoichiometrical relations existing between the different atoms, and molecules entering into them, that is, they indicate that in ordinary salt, e.g., the proportions, in weight, of the sodium and chlorine are as 23 to 35.5, or, that 23 grams of sodium, and 35.5 grams of chlorine will unite completely and yield 58.5 of sodium chloride. Stoichiometry therefore includes, in its wider meaning, much of chemical analysis, as well as the determination of atomic and molecular weights, and in physical chemistry is used in the more restricted sense of the determination of molecular weights in connection with association or dissociation among molecules of gases, liquids and solids.

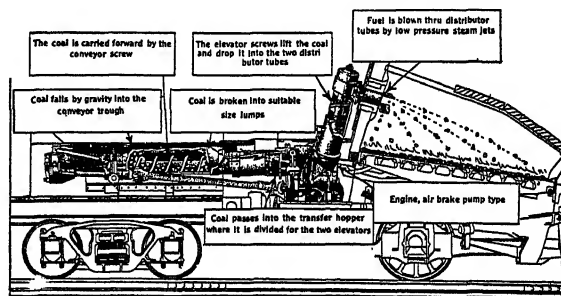
STOKE. See STOKES-UPON-TRENT.

STOKE POGES, a village in Buckinghamshire, England, famous for its association with the poet THOMAS GRAY. It is probable that Gray's famous *Elegy Written in a Country Churchyard* was inspired by the churchyard of St. Giles, the ancient Stoke Poges church, dating chiefly from the 13th century, in which the poet was later buried. The churchyard, included in Stoke Park and containing a monument to the poet, is now national property. About 1 mi. north is West End Farm where Gray's mother lived.

STOKER, BRAM (1848-1912), British author, whose real name was Abraham Stoker, was born in Dublin, Ireland, in 1848, and educated at Dublin University. While employed in the civil service he contributed literary and dramatic criticisms to various Dublin newspapers. In 1876 he was associated with HENRY IRVING in the management of the Lyceum Theatre, and later published *Personal Reminiscences of Henry Irving*. Stoker's other works include *Famous Imposters*, *The Snake's Pass* and *Dracula*. He died Aug. 22, 1912.

STOKERS, mechanisms which automatically feed coal into furnaces and dispose of the ashes and clinkers. Difficulties in the hand firing of mineral fuel in large quantities led to the invention of the automatic stoker about 100 years ago. The earlier stokers were of many varieties, but most types have been developed within the last 30 years.

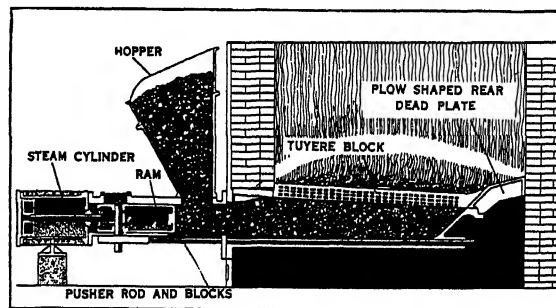
Stokers may be classified as 1. Over-feed, where the coal is fed forward over the inclined grate; 2. Under-feed, where the coal is forced up from below, the un-



OVERFEED STOKER ON RAILWAY LOCOMOTIVE

Coal falling into conveyor trough is carried forward and elevated by the screw and blown over the fire bed by steam jets

burned coal displacing the ashes which fall over the retort at the sides; 3. Multiple retort, where the coal is fed up from the bottom of the retort, the ashes and clinker falling over the end of the stoker onto the dump plate or clinker grinder; 4. Chain grate, where the travelling grate introduces the coal into the furnace at one end and takes out the ash at the opposite end; and 5. Finger or distributor stoker, where



COURTESY RILEY STOKER CORP.

UNDERFEED STOKER

Coal put in hopper is pushed up through the tuyere block by the steam ram

the particles of coal are thrown onto the fire by spring-actuated fingers, revolving blades or a jet of air.

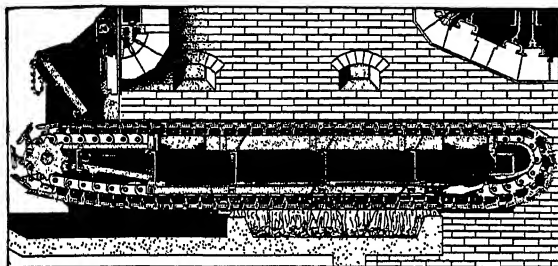
Over-Feed Stokers are used chiefly for the semi-bituminous types of the low volatile coals. They lend themselves to easy control and can efficiently handle rates of combustion as high as 800 pounds of coal per front foot of furnace per hour.

Under-Feed Stokers effect a saving in furnace upkeep, since they require no arch. However, the furnace temperatures with under-feed stokers are usually high, which may cause the upkeep of the other furnace brickwork to be comparatively costly, especially

with a poorly regulated draft. There is difficulty in removing the ash and clinker and its use has been confined to medium size and small installations.

Multiple Retort Stokers were developed to burn the low volatile semi-bituminous coals and are the standard stokers for large-size installations in the Atlantic states. They are very efficient and can burn as high as 2,000 lb. per front foot of furnace, the larger sizes handling over 30 tons of coal per stoker per hour.

Chain or Traveling-Grate Stokers may be used either with anthracite coals or with highly volatile bituminous coals, the travel of the grate and thickness of the fire being regulated so that the fuel is burned out before the end of the travel is reached. This requires, for efficient operation, higher pressures and larger amounts of air at the center of travel than at



COURTESY RILEY STOKER CORP.

TRAVELING GRATE STOKER

Coal is deposited on the top of the grate from the hopper at the left and carried into the furnace for burning

either end. These stokers are quite successful to-day and can burn as high as 2,000 pounds of coal per front foot of furnace per hour.

Finger stokers were developed for use in the internally fired Scotch Marine and Lancashire boilers but have been successfully applied to ordinary water-tube boilers of small sizes. In these furnaces the grates rarely exceed 6 feet in depth and it is seldom that over 400 pounds of coal are burned per front foot of furnace per hour.

Stokers are constructed chiefly of cast-iron, and a large portion of the maintenance costs lies in the replacement of the traveling grates or the tuyere blocks on the under-feed and over-feed types. The repairs are approximately proportional to the amount of coal burned per hour. The earlier stokers required excessive labor for cleaning the fires, as clinker troubles were great. When the *clinker grinder* was invented and proper space was allowed between it and the end of the stoker, the loss in combustible material in the ash was cut to a low figure and clinkering troubles were considerably reduced. A chain-grate stoker with the proper adjustment of air supply and thickness of the fire will operate nearly as efficiently as will the other types.

In the last four or five years small mechanical stokers have been applied to household furnaces with good results. They include all types and at least 20 or more different designs. In some types small mechanical conveyors take the fuel from the bin and deliver the ashes into the ash can, reducing the labor to

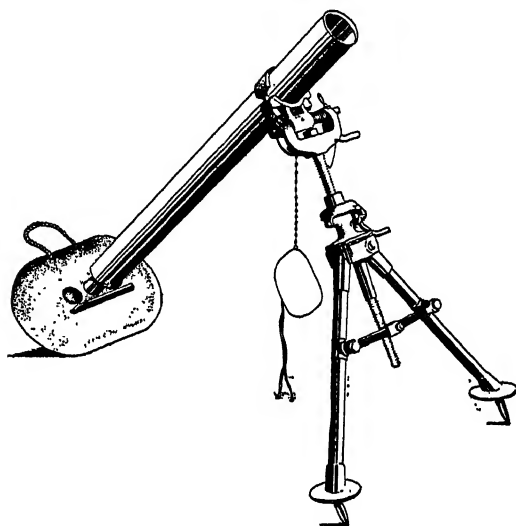
that of providing a coal supply and replacing the ash receptacle.

G. A. O.

STOKES, SIR GEORGE GABRIEL (1819-1903), English physicist, was born at Skreen, Ireland, Aug. 13, 1819. From 1854 to 1885 he was secretary and, until 1890, president of the Royal Society. He investigated problems of differential and integral equations, hydrodynamics and fluorescence. In the last field he made important researches into the absorption of light. He conducted the first studies of light-absorption spectra and investigated the ultra-violet end of the spectrum. He died at London, Feb. 1, 1903.

STOKES' LAW. See FLUORESCENCE.

STOKES MORTAR, a short steel smooth-bore tube permanently closed at one end, which closure carries a firing pin, equipped with a base plate and two supporting rods. The ammunition consists of a closed cylinder containing explosive and fuse. At the



STOKES TRENCH MORTAR

rear end a tube projects which carries a shot gun cartridge. The ammunition is inserted from the muzzle and slides down the bore, the shot gun shell striking the firing pin and firing the shot. The projectile was not guided in World War type mortars and turned over and over in flight. Additional power was obtained in this mortar by fitting rings of ballistic powder over the projecting tube on the cartridge. Its maximum range was about 800 yds. A new mortar produced in France, known as the Stokes-Brandt, operates in the same manner but guides the projectile with vanes. It attains a range of about 2,000 yds.

C. G. M.

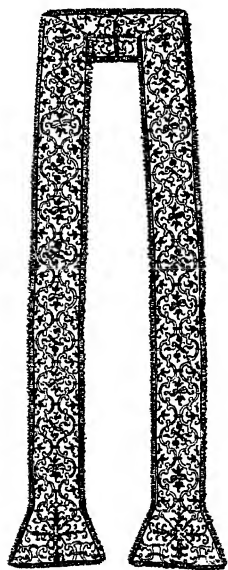
STOKE-UPON-TRENT, a city of Staffordshire, England, on the Trent River and Mersey Canal. The town is comparatively modern, dating only from the last quarter of the 18th century. It has some fine monuments, including a statue of JOSIAH WEDGWOOD who lived and died there. The extensive manufacture of porcelain and earthenware makes it

the center of the district known as the Potteries. Coal mines and deposits of clay are in the neighborhood. In 1910 Stoke-upon-Trent was united as a borough with Hanley, Burslem, Longton, Fenton and Tunstall. Pop. 1921, 267,647; 1931, 276,619.

STOLBERG, COUNT FRIEDRICH LEOPOLD (1750-1819), German poet, brother of Christian Stolberg, was born in Holstein, Nov. 7, 1750. He was educated at Göttingen and later was in public life, resigning in 1800 when he joined the Catholic Church. With his brother he wrote poems and a Greek tragedy with the object of arousing interest in Hellenic drama; to this end he also translated Homer, Plato and Aeschylus. He was noted for his poetical technique. Stolberg died near Osnabrück, Dec. 5, 1819.

STOLE, one of the ecclesiastical vestments used in the ritualistic churches. It is a long, narrow strip of silk richly ornamented and conforming to the **LITURGICAL COLORS**, which the priest, when vested

in the **ALB**, wears crossed over the breast and passed under the girdle. The deacon wears the stole crossed upon his left hip, and the bishop wears it hung around his neck with the ends falling straight down in front. The priest wears his stole just as the bishop does, when vested in the **SURPLICE** at certain services, and while preaching and administering the sacraments. In former times the stole was part of the coronation robes of the French and English kings and of the German emperors of the Holy Roman Empire. The stole fees are the stipends or offerings to the clergy by the faithful.



COURTESY M. M. OF ART
EMBROIDERED SATIN STOLE
French, 16th century

STOLP, a German city in the Prussian province of Pomerania, in the extreme northeastern part of Germany. The city has a medieval church and an old castle. It manufactures machines, furniture, wagons, amber goods, sausage and smoked meats, and has an active trade in grain, cattle, fish and geese. Pop. 1925, 41,602.

STOMA, called also stomate, a minute aperture in the epidermis of leaves, young stems, and other organs of plants. This opening functions in permitting of gaseous exchange between the internal tissues and the external air. The size of the orifice is determined by two guard cells which close the stoma at night and open it during the day. These guard cells are different from other epidermal cells, being crescent shaped, and containing chlorophyll. When plump and turgid with water they tend to pull apart, except

at each end, and thus produce an opening between the cells. On losing water they become limp and partially close the opening. The degree of opening varies with external weather conditions and day and night.

P. W. Z.

STOMACH, an important organ of the **ALIMENTARY CANAL**, consisting of a cornucopia-shaped bag with two openings and lying in the abdomen, immediately beneath the diaphragm. The upper end is the larger and has the form of a rounded dome, lying somewhat to the left. The esophagus, descending from the mouth at about the mid-line of the body, enters the stomach at its upper third, at what is known as the cardiac opening. From its large domed upper end, the stomach extends downward behind the front wall of the abdomen to the level of the navel, where it turns back again, then upward to the right, and posteriorly, to several inches below the end of the breastbone. At this point the stomach is narrower and more cylindrical, and leads into the first part of the small bowel called the duodenum.

Where the stomach joins the duodenum there is a circular ring of muscle fibers called the pylorus. When this ring of muscle contracts, it closes the lower end of the stomach.

The walls of the stomach are thin and are made up for the most part of muscle fibers, allowing the stomach to expand to a variable size. The muscles of the stomach are divided into three layers, longitudinal, oblique and circular coats. During digestion, the muscles contract in such a way that the thinner portions of the food contained within the stomach are ejected from time to time through the pylorus into the bowel, when the pyloric muscle is relaxed. At other times the food is entirely shut off from the rest of the alimentary tract.

During the fasting state, the stomach is small and practically empty of any fluid or solid contents. It always contains some air, so that it does not collapse completely. When food or drink enters the stomach, the muscles relax so that the contents are accommodated without any increase of internal pressure. The total capacity of the stomach is about three pints.

The stomach has an inner lining of mucous membrane and the outer surface is covered by a smooth moist membrane called the peritoneum. The lining of the stomach is immune to the solvent action of the digestive fluid. From the mucous membrane of the stomach is secreted the gastric juice, which is made up mainly of dilute hydrochloric acid and a substance known as pepsin. The acid and pepsin together can change insoluble proteins into soluble ones. Low temperatures retard the action of the pepsin and high temperatures hasten it. The best temperature is about that of the body. This liquefaction of solid proteins is the most important function of the stomach. Meat, fish, egg, milk curds, and other protein foods are acted upon in this way. (The digestion of proteins, however, is not confined to the stomach. Such work as the stomach leaves undone is completed in the intestine.)

There is also a substance secreted by the stomach known as rennin which has the property of curdling milk.

Starches, sugars and fats do not undergo important changes in the stomach.

ABSORPTION does not take place readily in the stomach. It is possible that there may be absorption of water, salts, sugars, proteoses and peptones and certain drugs, such as alcohol.

After a meal, emptying of the stomach is a gradual process, accomplished in from one to several hours depending upon the food eaten. *See also* DIGESTION.

For malformations of the stomach, *see* CHILDREN, DISEASES OF: Prenatal Diseases. M. F.

STOMACH OF ANIMALS. Man and such animals as the horse and hog have one stomach. In most birds the corresponding organs are a glandular stomach (proventriculus) and a gizzard, where grinding of the food occurs. Ruminants such as cattle and sheep have four stomachs. The feed is prepared for digestion in the first three and is acted on by the gastric juice in the fourth.

The stomachs of certain animals have important commercial uses, besides their utilization as water bags and sundry purposes by primitive people. The food product known as tripe is obtained from the stomach of hogs and the first and second stomachs of cattle and sheep. Hog stomachs are also used as sausage containers. The pyloric end of hog stomachs is likewise utilized for the making of pepsin.

D. S. B.

STOMATE, a small opening in the surface of a leaf. *See* STOMA.

STONE, HARLAN FISKE (1872-), American jurist, was born at Chesterfield, N.H., Oct. 11, 1872. After graduating at Amherst College in 1894, he spent four years studying law at Columbia University, where he was made professor of law in 1903. He was dean of the University's School of Law, from 1910 to 1924. In the latter year he was appointed to President Coolidge's Cabinet as U.S. Attorney-General. His most prominent achievement during his short tenure of this office was the effecting of a drastic reorganization in his department. On Mar. 2, 1925, he was elevated by Coolidge to an associate justiceship of the U.S. Supreme Court.

STONE, LUCY (1818-93), American suffragist, was born at West Brookfield, Mass., Aug. 13, 1818. After graduating from Oberlin College, 1847, she lectured against slavery in New England and Canada. In 1850, at Worcester, Mass., she helped to organize a national women's rights convention. After her marriage to Henry B. Blackwell in 1855, she retained her maiden name. She was president of the American Woman's Suffrage Association, 1869-72, then was connected with the *Women's Journal*, becoming editor in 1872. As a protest against taxation without representation she permitted her estate to be sold for back taxes. She died in Boston, Oct. 18, 1893.

STONE, MELVILLE ELIJAH (1848-1929), American newspaper publisher and manager, was

born in Hudson, Ill., Aug. 22, 1848, and educated in the Chicago public schools. At 16 he became a reporter for a Chicago daily and subsequently was connected with other newspapers until finally in 1875 with two partners he established the *Chicago Daily News* which was sold in 1888. Stone established the Globe National Bank in Chicago in 1891 and served as its president until 1899. In 1893 he was chosen general manager of the Associated Press which he developed from a small bureau into a leading source of world-wide news, and was advanced in 1921 from manager to counselor for that organization. He died in New York City, Feb. 15, 1929.

STONE, BUILDING. Under this heading are included all natural stones employed for ordinary MASONRY work, including interior and exterior decoration, roofing and flagging. The factors which affect the selection of a building stone are cost, strength, durability and ornamental value. Stones generally used in building work are: GRANITE, SANDSTONE, LIMESTONE, MARBLE and SLATE.

Granite is quarried extensively in some of the New England states although found in considerable quantity and variety in other parts of the U.S. Sandstone is quarried principally in Ohio and limestone in Indiana. Marble is found in a great variety of color and texture in different locations in the U.S. though considerable marble is imported from foreign countries. Slate is obtained from Maine, Vermont, New York, Pennsylvania and Maryland. G. A. H.

STONE AGE, the general name describing a series of stages of human culture in which men, as yet unacquainted with the use of the metals, made many of their weapons and implements of stone, particularly of flint. The Stone Age is not a particular period of time. It merely defines one element, the use of stone in place of metals, over a period beginning with our earliest knowledge of man and lasting to the present day.

Stone implements have been used by men from times inconceivably remote, so that in general the name Stone Age suggests antiquity. But two or three centuries ago, stone weapons and implements were in general use over a large part of the earth, notably in North and South America, Australia and the Pacific islands. And in the interior of New Guinea stone implements are in use to-day. A photograph taken in 1929 shows the users of stone axes eagerly exchanging two dried human heads, their most prized trophies, for a ten-cent knife. Wholly ignorant of iron a few years ago, these New Guinea natives are now beginning to recognize its usefulness and will go to great lengths to obtain it.

That the use of stone implements instead of metal does not necessarily imply an extremely low and undeveloped condition of human life is the next important truth to be kept in mind. The natives of North America were in the Stone Age three or four centuries ago. At the same time they had an intricate tribal system resting on the election of chiefs chosen for valor and wisdom, and had complex social

systems. They had a great many highly developed languages, indicating many centuries of development, and oral traditions and songs, historical, poetical and religious. Their religious ceremonies were based on reverent recognition of the Great Mystery, and they had definite beliefs regarding the soul's survival. Yet they had arrowheads of chipped flint not greatly different from those found far back in Palaeolithic time (*see* PALAEOLITHIC PERIOD).

In the same way a study of the natives of interior New Guinea, still in the Stone Age, shows that the use of stone implements may go with a considerable degree of material culture. That it is possible to fell a tree with a stone ax was proved by a Danish archaeologist, who himself fitted a stone ax with a haft and cut down a tree. The natives of interior New Guinea cut down trees, shape planks for elaborate canoes, and build large houses on piles, using only stone implements. They have also many complicated arts, social systems and a traditional history and mythology.

Man of the Old Stone Age in Europe was a hunter. His chipped flint implements were used to kill, skin and cut up his game. It is, therefore, quite likely that he made tents of hides, following the general style of the original American Indian tepees of buffalo hide, and that he made clothing of carefully dressed skins, as the American Indians did. During periods of extreme cold, men became cave-dwellers, at least during the winter, but it is not impossible that they had tents of skin for summer use even during the Ice Ages, just as the Eskimos of Greenland alternate between summer and winter homes. In the warmer intervals of the Interglacial periods, especially after the flint ax had been developed, men felled trees and built houses. They also hollowed out canoes from large tree stems, going considerable distances from the shore, as is shown by the bones of deep sea fish which they caught. In the period of polished stone axes, trees were felled in large numbers to supply piles and building material for the lake dwellings, for example, in Switzerland. At one settlement on a small lake in the canton of Zurich 100,000 piles were used.

A chronology of the various periods of the Stone Age is based on the occurrence of successive types of implements and weapons with the bones of animals now extinct, like the cave lion and cave bear. The woolly rhinoceros and woolly mammoth; animals no longer found in Europe, like the elephant and hippopotamus, now inhabiting regions much warmer and far to the south; or animals like the reindeer and musk-ox, now found in regions much colder and nearer the polar regions. The contrast between the animals of much warmer and of much colder climates corresponds to the presence in Europe of much warmer and of much colder climates. This in turn corresponds to the warmer climate of the Pliocene period and of the successive warm Interglacial periods, and the succession of cold periods, which taken together make up the Glacial period, or Age of Ice. A succession of alternately cold and warm

periods has been traced through the Pleistocene, or Quaternary, Period, and a detailed chronology of the close of the Age of Ice has been worked out from the yearly layers of clay, which correspond to the yearly rings of growth in a tree.

For the latter part of the Stone Age a chronology has been deduced from the succession of trees found in the mosses, formerly lakes, in the island of Seeland, Denmark. Lowest come poplars and aspens; above these is the Scotch pine, associated with implements of the Azilian and Tardenoisian type. Above this comes the oak, with implements belonging to the Neolithic, or polished stone, and Bronze periods. Finally there are the beeches of modern Danish forests, associated with implements of the Iron Age. *See* ARCHAEOLOGY. C. J.

STONE-BORER, the popular name for bivalve mollusks which bore into stone. They belong to three different genera, the date-shells (*Lithodomus*), the piddocks (*Pholas*) and *Saxicava*.

STONE CARVING, a kind of stone sculpture which is carved out from a background, as distinguished from stone sculpture in the round. The earliest examples of this art are carvings made by Palaeolithic man on the walls of caves in Dordogne, southern France. In one cave are four bas-reliefs of the human body, one of them of a woman holding a buffalo horn. In another cave in the same valley are carvings representing bison.

The ancient civilizations of Asia Minor were noted for their sculptured bas-reliefs. The earliest known example comes from the Sumerian period. It is carved from white limestone on a background of slate and shows a king slaughtering his enemies. This dates from the First Dynasty after the Flood or between 3000 B.C. and 2500 B.C. Stone bas-reliefs reached their height under the Assyrian king Ashurbanipal in the 7th century B.C. and from the ancient palace of Asoka in Bengal, India, come stone carvings on edict pillars with elaborately carved capitals which equal anything found in the contemporary palaces of Susa and Ecbatana.

The remains of the Mayas in Central America show an almost unbelievable mastery of stone carving. Especially is this true when one takes into account the fact that these elaborate carvings which enrich their monuments and temples were made entirely without the use of iron tools. Cave temples in India and China have always been a favorite place for stone carvings. At Elephanta and Ellora in India are extensive caves whose walls are decorated with carvings of the three-headed god Siva and other Hindu deities. The greatest collection of early Buddhist carvings are in the cave temples of Yun Kang in Shansi and of Lao Chun Tung at Lung Men, executed in the 5th and 6th centuries. The carvings include colossal Buddhas and Buddhavistas, some of pure Chinese inspiration and some which show the influence of Indian Buddhist conventions.

A modern example of stone carving which is to be on a more gigantic scale than anything ever attempted

STONE AGE



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

ART OF THE STONE AGE IN EUROPE

1. Baton de commandant of reindeer antler. 2. Harpoon. 3. Bison. 4. Partly restored dart thrower. 5. Incised drawing of wild ox. 6. Head of a horse. 7. Horse carved in

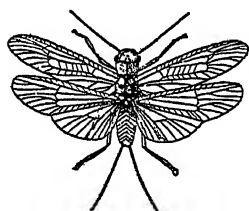
mammoth ivory. 8. Ivory female head. 9. Deer and fish drawing on reindeer antler. 9A. Cast of 9 flattened out. 10. The stone Venus of Willendorf.

is the Confederate Memorial being carved on the side of Stone Mountain near Atlanta, Ga.

STONECHAT (*Pratincola rubicola*), a small European song bird of the thrush family, so called from its sharp alarm note which resembles the clicking together of pebbles. It is about $4\frac{1}{2}$ in. long, mostly black above, with a white collar, wing spot and tail markings, and reddish below. In summer it is common in the British Isles and most of continental Europe, migrating to Africa and Asia Minor in winter. Active and restless, it usually frequents open grassy country, where it is generally seen on the ground, though it also perches on bushes from which it darts out after insects in the manner of flycatchers. It nests on the ground, often under a tuft of grass, and lays five or six bluish-green, spotted eggs. Its song is short but pleasing.

STONECROP, the common name for a large genus (*Sedum*) of low fleshy herbs of the orpine family many of which are grown for ornament. The common or mossy stonecrop (*S. acre*), called also wall pepper, native to the Old World and widely naturalized elsewhere, is extensively cultivated as a cover plant for walls and rocky places. It is a smooth creeping evergreen forming broad mats and bearing bright yellow flowers on short stalks.

STONE-FLY, an insect of the order *Plecoptera*. The adults generally have four membranous wings, the hind pair usually being the larger. When at rest, the wings are folded in plaits upon the abdomen. The mouth parts of some species are vestigial, but in most species they are functional and fitted for chewing. Two long jointed tails are usually present at the tip of the abdomen. They are dull brown or gray in color and lay eggs in a mass in water. The



STONE-FLY
Perla pallida

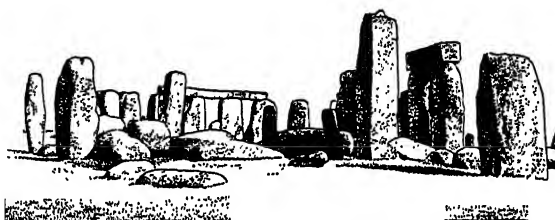
nymphs are aquatic and are found in swift-flowing streams clinging to the under surfaces of rocks. They feed mainly on plants, although some eat other insects. Their bodies are flattened and two tail-like appendages are present at the caudal end of the body. The nymphs of some species are brightly colored. They leave the water when ready to transform, their empty skins being often seen on rocks in streams. Nymphs are eaten eagerly by trout.

STONE FRUITS, the name given to fleshy fruits with a stony inner structure inclosing a single seed, especially to drupes as the peach, nectarine, apricot, plum and cherry. Other examples of stone fruits are the olive and litchi.

STONEHAM, a town and village in Middlesex Co., northeastern Massachusetts. The village is situated 9 mi. north of Boston and is an independent branch of the Boston post-office. It is served by the Boston and Maine Railroad. The chief local manufactures are shoes, shoe stock, leather, drugs and

chemicals. The retail trade in 1929 amounted to \$3,129,919. The Stoneham mill owners were pioneers in the use of steam power and labor-saving machinery in making shoes. Within the town's limits is Spot Pond, a storage basin for the metropolitan water district, and more than 700 acres of the Middlesex Fells Reservation. The site of Stoneham was settled in 1668, and became known as Charlestown End. Separating from Charlestown, it became an incorporated town in 1725. Pop. 1920, 7,873; 1930, 10,060.

STONEHENGE, an ancient group of huge stones, on Salisbury Plain, Wiltshire, England. The date and purpose of their erection is not known, but they are



STONEHENGE, NEAR SALISBURY, ON SALISBURY PLAIN, ENGLAND

thought to be of the early Bronze Age and to have served as a temple or tomb. Stonehenge consists of an outside circle, 100 ft. in diameter, of monoliths of sandstone and an inner circle, of irregular boulders or "blue stones," 82 ft. in diameter; inside of which are two ellipses of smaller stones in horseshoe shape and, at the central curve, a flat "altar stone," 4 by 15 ft. A tall monolith, called the "frier's heel," stands outside at the open end at the northeast, so placed that the sun rose over the spot. This has led to the belief that Stonehenge was built by sun worshippers. It has also been variously said to be the work of Romans, Druids, Phoenicians, Saxons and Danes. One theory is that Merlin moved it from Ireland, another that it was a monument to the 400 nobles slain by Hengest, still others think it was Boadicea's tomb.

STONE MOUNTAIN, a huge dome-shaped hill of solid gray granite situated about 15 mi. east of Atlanta, Ga. It rises to a height of 867 ft. and covers approximately 2 sq. mi. A few shrubs and small trees have taken root in hidden hollows but the mountain appears to be one tremendous mass of naked stone unadorned by vegetation. It is reached by an electric railway from Atlanta and it is also on the route of a U.S. Interstate Highway. A path leads up the mountain to the summit which commands a superb view of the surrounding country. See also **STONE MOUNTAIN MEMORIAL**.

STONE MOUNTAIN MEMORIAL, when completed, will be a gigantic Confederate memorial carved upon the side of Stone Mountain, a barren solid dark grey granite hill 867 feet high and nearly one mile in length, located about 15 miles north of Atlanta, Ga. The complete design includes the Southern leaders on horseback, a pageant of the Confederate army

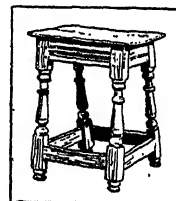
passing in review, a memorial hall containing a seated stone figure representing Immortal Valor, dedicated to the women of the Confederacy, and a pool. The work was begun in 1917 under Gutzon Borglum after his drawings had been accepted by the Stone Mountain Memorial Association, but was interrupted by the World War. Work was resumed again in 1923 and a dispute led to the dismissal of Borglum in 1925. Augustus Lukeman took over the work in 1926 and had completed two-thirds of the three great equestrian leaders, Davis, Lee and Jackson, when a shortage of funds called a halt to the work in 1928. Since then nothing has been done on it, but the work is to be continued whenever the necessary funds are available. The pageant, which is to be to the left of the leaders, will consist of infantry, artillery and cavalry together with 52 mounted figures comprising four leaders from each state. Below the carving of the great leaders will be the Memorial Hall, cut out of solid rock, circular in plan, and in proportions as large as the Lincoln Memorial in Washington, the walls of which will be 13 colossal memorial tablets, one for each state on which the names of those who fought for the Confederate cause will be inlaid in gold. The stone figure in the hall will be 22 ft. high and will be located in the center. At the base of the approach to the building will be a reflecting pool 300 ft. long and 150 ft. wide in which will be a stone boat supporting figures of the naval leaders of the Confederacy. It is estimated that \$2,000,000 will be required to complete the hall.

STONE ROLLER (*Compostoma anomalum*), a small fish of the carp family (*Cyprinidae*), abundant in the deep waters of streams throughout the Mississippi Valley. It has a brown body with orange fins. During the spawning season, the head and sometimes the entire body of the male is covered with large tubercles. Stone rollers are noted for the length of their intestine, coiled 12 or 15 times around the air bladder. A small sucker (*Catostomus nigricans*), which disturbs small stones, when it is frightened from its resting place on the bottom of a stream, is also called stone roller. It is found chiefly in the Middle West.

STONY POINT, BATTLE OF, July 16, 1779, one of the chief battles of the REVOLUTIONARY WAR which resulted in a brilliant triumph of the American forces under Gen. Anthony Wayne. Stony Point and Verplanck Point, on opposite sides of the Hudson about 40 miles above New York City, were seized by the British in May 1779, and fortifications begun by the Americans were completed. Six hundred regulars under Lieut.-Col. Johnston were garrisoned at Stony Point, and several vessels of war were stationed within cannon range. Washington outlined to Wayne a plan for the assault of the fort. Following these instructions in detail, Wayne divided his force into two columns, which moved to the attack at different points simultaneously. Two companies under Maj. Murfey drew the fire of the British while the two columns traversed the marsh between the

main land and the promontory of Stony Point in absolute silence. Scaling the parapet and entering the fort on either side, the invaders overcame the British defense, and the fort was surrendered. The American loss was 15 killed and 83 wounded; the British, 20 killed, 75 wounded, and about 500 officers and men taken prisoners.

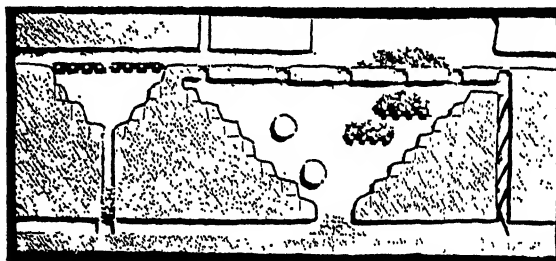
STOOL, a backless and armless seat for one person. Chests and stools were the ordinary seats in medieval times. Some stools were plain and primitive, of trestle form, with truss supports; others had from one to four gracefully shaped and elaborately carved legs, and were luxuriously upholstered. The X-shaped stools, which folded like modern camp stools, were often draped, even in the ancient Greek period, with rich leather or embroidered cloth for persons of rank. When chairs were reserved for lords and princes, lesser folk sat on stools. The right to sit on a stool in the king's presence was the basis of many a court squabble both in France and England.



COURTESY M. M. OF ART
AMERICAN COLONIAL STOOL

A stool may also be a portable support for the feet, or for the knees in kneeling. Adjustable "gout stools" were advertised by Hepplewhite in 1775.

STOPE, in mining, one of a series of underground excavations made to remove ore during the exploitation of a mine. Its shape depends on the ore deposit and the stoping method employed. "Filled stopes" are filled with waste, after the ore has been removed, to prevent their caving in, or to dispose of the waste. "Open stopes" are left without any filling, where the ground is sufficiently solid. In "caved stopes," there is no permanent support to keep the excavation open, and it is allowed to cave in after the ore has been extracted. In "underhand stopes" excavating pro-



FROM W. R. CRANE, ORE MINING METHODS, JOHN WILEY & SONS

UNDERHAND STOPING METHOD

Levels above and below stope, raises through which ore is removed, wall pillars in large stope, and waste piled on stulls are shown

ceeds from a level downward, in "overhand stopes" from below upward. "Shrinkage stopes" are overhand stopes, in which sufficient broken ore is removed to leave working room, men and machines standing on the fill while working; after the stope has reached the next level, the broken ore remaining in the stope is drawn off. Various CAVING methods are used in stoping large deposits. In all these methods the ore is

allowed to fall through chutes to a lower level, where it is trammed to the shaft. *See also* MINING, METAL.

STORAGE CELL, a device for converting electrical into chemical energy which it "stores" and subsequently reconverts into electrical energy. It consists of two plates, or grids, in a single ELECTROLYTE. Each of the two plates, however, is usually composed of several single grids connected together and so placed in the containing jar that the arrangement is

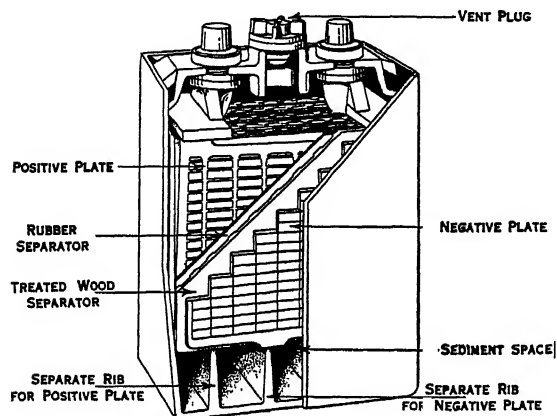


FIG. 1. STORAGE CELL

equivalent to several cells in parallel (*see* ELECTRIC BATTERIES). The storage cell does not differ essentially from a simple voltaic cell except that the electrolyte does not polarize and that the chemical changes which take place during discharge may be reversed and the active material restored to its original condition by passing an electric current through the cell in a direction opposite that of the discharge. No

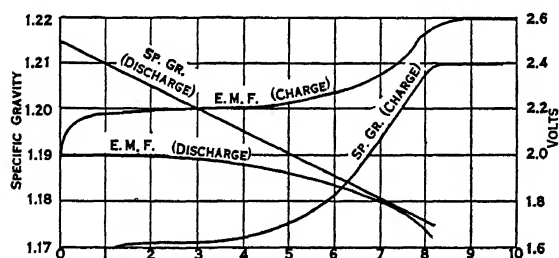


FIG. 2. CHARACTERISTIC CURVES (CHARGE, DISCHARGE, DENSITY) FOR LEAD STORAGE CELL

electricity is actually stored in the cell. The energy of the charging current is expended in producing a chemical change. This energy then exists in the form of chemical potential energy which is reconverted into electric energy as the cell discharges.

Lead Storage Cell. This type of cell, shown in Fig. 1, consists of two or more grids of LEAD or lead-antimony alloy which support the comparatively fragile active materials immersed in dilute SULPHURIC ACID (H_2SO_4). In the charged condition, the active

material of the positive plate is lead peroxide (PbO_2), and of the negative plate, spongy lead (Pb). During discharge, the negative IONS of the H_2SO_4 combine with the active materials in both of the plates and change them to lead sulphate.

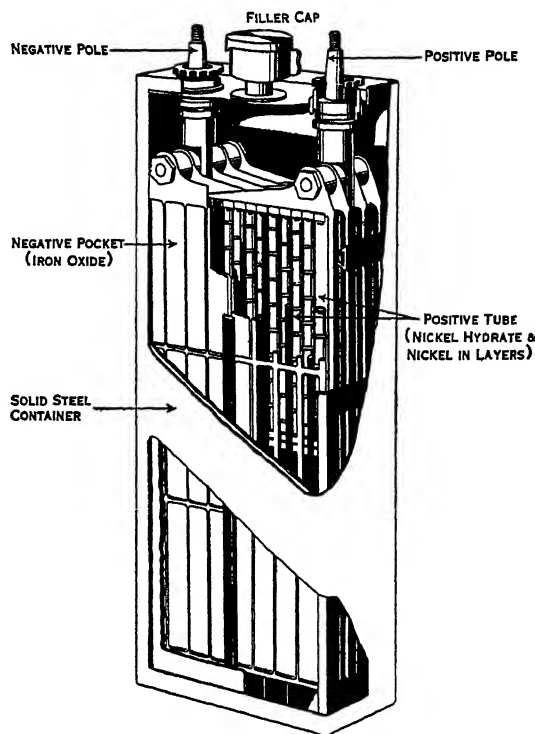
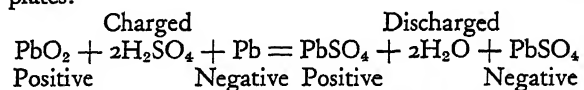


FIG. 3. EDISON STORAGE CELL

The following formula shows the composition of the plates:



The withdrawal of H_2SO_4 from the electrolyte and the formation of H_2O causes the density of the elec-

2.00
1.80
1.60
1.40
1.20
1.00

FIG. 4. VARIATION IN VOLTAGE OF AN EDISON CELL ON CHARGE AND DISCHARGE AT NORMAL RATE

trolyte to diminish; hence, the state of charge may be measured by the density of the solution. Fig. 2 gives the curves showing the relation between the electromotive force of the cell and the density of the solution at different states of charge and discharge.

Edison Storage Cell. The positive plates of this cell (Fig. 3) consist of nickel oxide (NiO_2) packed in alternate layers with nickel flakes in perforated nickel-plated steel tubes. The negative plates are finely divided iron packed in perforated pockets of the same material as the tubes of the positive plates. The electrolyte is potassium hydroxide (KOH).

The chemical changes within the cell are not definitely known, but during discharge, the NiO_2 changes to Ni_2O_3 and the iron to Fe_3O_4 . The density of the solution is 1.20 and does not change appreciably during the cycle of charge or discharge. The state of the charge of the cell is determined from its voltage as shown in the figure. A. Z.

STORAX, a fragrant balsamic resin, the styrax of the ancient Greeks, derived from the storax tree (*Styrax officinale*), native to the Mediterranean region. It was formerly much used in medicine and for incense but is no longer an article of commerce. Liquid storax is a balsamic, honey-like substance obtained from the bark of the oriental LIQUIDAMBAR (*Liquidambar orientale*) and also from the American SWEET GUM (*L. styraciflua*). It is used in medicine as an expectorant and also in perfumery.

STORK, the common name for a family (*Ciconiidae*) of large voiceless birds of striking appearance, allied to the herons and ibises. The true storks (*Ciconia*), comprising three species found only in the Old World, have plump bodies, strong wings, long legs and large, sharp-pointed bills. The handsome white stork (*C. ciconia*), which stands about 3 ft. high, is pure white, with black on the wings, and the bill, legs and feet red. It breeds widely throughout Europe and also in central Asia, migrating in immense flocks to winter in Africa and northern India. Although sometimes nesting among rocks or in trees, it usually seeks human habitations to breed, selecting a chimney or house top as a site for its bulky nest of sticks and reeds which it enlarges each year. It lays three to five white eggs and feeds upon frogs, birds, reptiles, small mammals and insects, which it secures in neighboring pastures or marshes. The stork has entered extensively into folklore and fable and has long been an object of superstition and reverence in various countries of central Europe where it is protected because of its value as a scavenger and by the belief that it is a bearer of good fortune. It is an old superstition that the stork flies over the house where a birth is about to take place. The black stork (*C. nigra*), a smaller bird than the white stork but of similar range, inhabits secluded swamps, nesting in tall trees.

STORKSBILL. See FILAREE.

STORM, THEODOR (1817-88), German poet and novelist, was born at Husum, Schleswig, Sept. 14, 1817. He was appointed Landvogt and Amtsrichter in his native town. In 1852 he produced *Immensee*, a short tale that became famous. This was followed by *Gedichte*, 1853, a volume of delicate and melancholy lyrics covering a range of topics familiar to romantic poets. Storm's masterpiece, *Aquis Sub-*

mersis, 1877, is a much more virile novel than the sentimental *Immensee*. In general his work formed a link between ROMANTICISM and modern literature. Storm died at Hademarschen, Holstein, July 4, 1888.

STORM, a term frequently used to denote a very strong wind or gale, whose intensity on the Beaufort scale of wind strength is 10 or 11 and whose velocity is around 50-60 miles per hour, but more generally employed to designate any violent meteorological disturbance, such as SQUALLS, TORNADOES, thunderstorms and SANDSTORMS and the rotary storms such as HURRICANES and TYPHOONS in the tropics and the familiar CYCLONES in temperate latitudes, which include rain-, hail- and snow-storms.

The latter type is caused by two currents of air meeting, a colder one flowing southward from high latitudes, in the northern hemisphere, but deflected into a westward wind by the earth's rotation, and a warmer one flowing north, but similarly deflected into an eastward one. The dividing surface between the two becomes ruffled, and an indentation is made in one of the currents, after which they begin to billow around each other, gradually forming a cyclone. Such a storm often has a warm front, from which much heavy rain precipitates, and is terminated behind by a cold front, which produces showers.

The barometric pressure generally falls when such a storm is approaching, and rises as soon as the storm center has passed. The approach of a storm may be predicted by studying the motion of lows, or areas of low pressure, on a weather chart. Sometimes a cyclone is accompanied on its side by a smaller one, which, though very brief in duration, may be much more severe. In the northern hemisphere such storms generally move toward a northeasterly direction.

STORM AND STRESS (German *Sturm und Drang*), in German literature, the name applied to a period of intellectual awakening and of violent revolt, covering the last quarter of the 18th century. The movement, which was named from F. M. von Klinger's convulsive drama, *Sturm und Drang*, 1776, was a kind of ROMANTICISM, violently opposed to all prevailing customs in literature, government, society and religion, and as violently embracing Nature, originality and "genius." Much influenced by the plays of Shakespeare, it found its greatest expression in dramas which romantically depicted gigantic passion, with plot or dramatic structure subordinated to these passions; although it also expressed itself in poetry and fiction. The fundamental principles of Storm and Stress were set forth in a pamphlet *Von deutscher Art und Kunst*, 1775, written chiefly by Goethe (1749-1832), Herder (1744-1803) and Moser (1720-94), and these three men, with the addition of Schiller (1759-1805), were the outstanding leaders of the movement. Goethe's drama, *Goetz von Berlichingen*, and his novel, *Werther*, were eminently in the *Sturm und Drang* spirit; as were also Herder's philosophy of Individualism and Schiller's romantic drama, *Die Rauber*, or "The Robbers." Minor dramatists were Lenz (1752-91), Wagner (1747-79), Leiswitz (1752-

1806) and Maler Muller (1750-1814). Of the poets connected with the movement, the most noteworthy were Voss (1751-1826), Holtz (1748-76), Burger (1748-94), Claudius (1740-1815) and Klopstock (1724-1803). The important novelists of the period were Jacobi (1757-93), Miller (1750-1814), Heinse (1749-1803) and Moritz (1757-93). *See also* GERMAN LITERATURE; GERMAN DRAMA; separate articles on above authors.

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STORM AND WEATHER SIGNALS are signals displayed on the roof of a weather bureau or on a mast in a conspicuous place at every principal port to indicate the weather forecast and to warn navigators of impending bad weather. They may consist of the lighting of lamps, the raising of such signals as a cone or a ball, or the hoisting of flags. For daylight warnings the U.S. Weather Bureau employs the latter method, and uses three different symbols, viz., a red pennant, a white pennant and a square red flag with a black square in the center, different combinations of which indicate the approach of six different kinds of bad weather.

The single red pennant denotes a moderately strong wind dangerous only to small craft. A red pennant above the red flag with a black square warns of the approach of an ordinary bad gale or heavy storm from the northeast, while a storm from the southeast is indicated by a red pennant below the square red flag, one from the southwest by a white pennant below the square red flag, and one from the northwest by a white pennant above the square flag. The warning signal for an extremely violent storm or a hurricane consists of two square red flags with a black square, one shown above the other.

At night no signal for storms dangerous to small craft is given, but the expectation of the other five mentioned above is indicated by means of a display of red and white lanterns, similar to that with flags.

STORM LAKE, a town in northwestern Iowa, the county seat of Buena Vista Co. It is situated on the lake of the same name, 80 mi. northeast of Sioux City, and is served by three railroads. Storm Lake is a summer resort with fishing and boating. There are some manufactures, including canned corn, wood products, chemicals and cement. Farming and stock-raising are the leading interests of the countryside. Pop. 1920, 3,658; 1930, 4,157.

STORY, JOSEPH (1779-1845), American jurist, was born at Marblehead, Mass., Sept. 18, 1779. He was graduated at Harvard in 1798 and admitted to the bar in 1801. In 1805 he was elected to the State legislature and in 1808 to Congress. President Madison appointed him an associate justice of the United States Supreme Court in 1811, when Story was 32 years old. While serving on the bench he was professor of law at Harvard University. His chief work was in moulding American equity jurisprudence.

Among his works are *Commentaries on the Law of Parliament, Constitution of the United States and Equity Jurisprudence*. He died at Cambridge, Mass., Sept. 10, 1845.

STORY, WILLIAM WETMORE (1819-95), American sculptor, legal author and poet, son of JOSEPH STORY, was born at Salem, Mass., Feb. 19, 1819. He graduated from Harvard in 1844 and studied law under his father. After being admitted to the bar he decided to devote his life to sculpture and took up a permanent residence in Italy. Among his works are statues of Edward Everett, Boston; George Peabody, London, and Francis Scott Key, San Francisco. He wrote legal treatises and several volumes of poetry. Story died in Vallombrosa, Italy, Oct. 7, 1895.

STOUGHTON, a town, including Stoughton and a number of smaller villages, in Norfolk Co., eastern Massachusetts. Stoughton village is situated about 16 mi. south of Boston. The New Haven Railroad serves the town. There are truck farms and various factories within the town. The chief manufactures are shoes, lasts, woolen and knit goods, water coolers, elastic webbing, rubber goods, piano parts and clothing. Stoughton has also a machine shop and brass foundry. Doty's Tavern, which dates back to pre-Revolutionary times, is an interesting landmark. Stoughton was separated from Dorchester and incorporated as a town in 1726. Pop. 1920, 6,865; 1930, 8,204.

STOWE, HARRIET ELIZABETH BEECHER (1811-96), American novelist, was born June 14, 1811, at Litchfield, Conn. Her family moved in 1832 to Cincinnati, O., where she assisted her older sister in establishing a school for girls. In 1836 she married Calvin E. Stowe, a professor of theology. She early began writing and was the author of many novels. But her one outstanding work was *UNCLE TOM'S CABIN*, 1852. It was translated into many languages, and in the United States and England millions of copies have been sold. The author wrote the book under the greatest difficulties and handicaps due to her husband's inadequate salary as a professor of theology. Mrs. Stowe died July 1, 1896, at Hartford, Conn.

See Life and Letters of Harriet Beecher Stowe, ed. by Annie Fields, 1897.

STRABISMUS. *See* EYE, AFFECTIONS OF: Malformations.

STRABO (c. 64 B.C.-19 A.D.), celebrated Greek geographer, was born at Amasia in Pontus. He traveled extensively throughout Egypt, Asia Minor, Greece and Italy, spending several years at Rome. He is the author of a geography consisting of 17 books, which is considered to be one of the most important geographies of ancient times, and has been translated into many languages. It contains historical and topographical accounts of different countries of his time, based partly on his personal observations, but mostly on that of other authorities, particularly Eratosthenes. Eight books are devoted to Europe,

six to Asia, and one to Egypt and Libya, while the first two books form the introduction. Strabo died about 19 A.D.

STRACHEY, GILES LYTTON (1880-1932), British author, was born Mar. 1, 1880, and was educated at Trinity College, Cambridge. He devoted himself chiefly to biographical studies, publishing *Eminent Victorians*, 1918; *Queen Victoria*, 1921; *Elizabeth and Essex*, 1928, and *Portraits in Miniature*, 1931. Other works have been *Landmarks in French Literature* and *Books and Characters*. Strachey's biographies have attracted much attention and aroused controversy because of his frequently iconoclastic temper and sardonic mood. His vivid writing, his caustic description and ironic humor, tending to reveal character and motives in unsuspected but frankly human lights, are qualities which furnish the basis for a new school of biography. Strachey died at Inkpen, Berkshire, Jan. 21, 1932.

STRADIVARI, ANTONIO (1644-1737), Italian violin-maker, was born at Cremona in 1644, the month and day unknown. He was the foremost violin-maker of his time, having a mild rival only in **NICCOLO AMATI** with whom he is believed to have studied. More than 500 violins and 50 violoncellos from his hand have survived, and they represent, despite their age, the highest degree of perfection attained in the entire history of violin design. The earliest violin which he is known to have made is dated 1666. He married twice, Francesca Feraboschi in 1667, and Antonia Zambelli in 1699, and had eleven children, two of whom, Francesco Stradivari (1671-1743) and Omobono Stradivari (1679-1742), followed his craft. He died at Cremona, Dec. 17, 1737.

STRAFFORD, THOMAS WENTWORTH, EARL OF (1593-1641), English statesman, was born at London in Apr. 1593. After his election to Parliament he championed the rights of that body, but later became a follower of King Charles I. In 1633 he went to Ireland as Lord Deputy, and administered the country with a stern hand. After his return to England in 1639 he was appointed to put down an insurrection in Scotland, but a treaty was signed before he could join the army. The Long Parliament, meeting in 1640, passed the bill of attainder which resulted in the statesman's being beheaded in May 1641.

STRAGGLER, a soldier who fails to maintain his proper place with his organization, who wanders away from the regular route, or roves about without authority and direction. A straggler often becomes a deserter. The rear guard of a marching command picks up stragglers, as does also the military police of the area. *See also* **DESERTER**.

STRAIGHT COLLEGE, at New Orleans, La., the first school in Louisiana to offer educational opportunities to Negroes, was founded in 1869 by the American Missionary Association. The United States Government erected the first building. The college is coeducational, privately controlled, and partly supported by the American Missionary Association. Be-

gun as an elementary school, it gradually developed higher departments until it attained collegiate standing. The grounds and buildings were valued in 1931 at \$831,200. In 1931-32 there were 218 students and a faculty of 32, headed by Pres. Charles B. Austin. Plans for merging Straight College and New Orleans University as Dillard University were completed in 1932.

STRAIGHT DEMOCRATS, 1872, members of the Democratic party who refused to accept the action of the national committee in endorsing the LIBERAL REPUBLICAN ticket, headed by Horace Greeley for president, and nominated a second set of candidates. Charles O'Connor, brilliant member of the New York bar, who had won southern favor by sharing the bail bond of JEFFERSON DAVIS, was put forward for president, and JOHN QUINCY ADAMS for vice-president. Both nominees declined, but the ticket was not withdrawn and received 21,559 votes. The NATIONAL LABOR REFORM PARTY also endorsed O'Connor.

STRAIN. *See* **ELASTICITY**.

STRAITS QUESTION. The commercial and strategic importance of the Bosphorus, the Sea of Marmora, and the Dardanelles, as the water gateways between the Black and Mediterranean seas has resulted in several attempts to internationalize the Straits. On the other hand, Russia, since the time of Peter the Great, has harbored ambitions to control them and possess Constantinople. The latest Straits Convention was signed in 1923. By its terms Turkey agrees that the straits shall be open in time of war as well as in time of peace to neutral merchant vessels. An International Straits Commission is given supervisory power. F. M. R.

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STRAITS SETTLEMENTS, territory and islands forming a British crown colony on and near the MALAY PENINSULA. The name is derived from the Strait of Malacca, which divide the peninsula from Sumatra. The colony comprises a number of isolated tracts of land and includes MALACCA, the Dindings and Province Wellesley on the peninsula, and the islands of Penang and SINGAPORE, as well as the more distant Cocos Islands, Christmas Island and the colony of Labuan off the island of Borneo. The total area is about 1,600 sq. mi. with a population of 883,769 in 1921. The estimated total population of the colony in 1928 was 1,095,635.

The two most important sections are Singapore Island, covering 217 sq. mi. and having a population in 1921 of 425,912, and Penang Island with an area of 108 sq. mi., and a total of 304,335 inhabitants in 1921. Chinese predominate among the population, and there are large numbers of Indians. The essentially rural Malays are not conspicuous either by numbers or activity. Every year large numbers of Chinese coolies arrive from Canton and other parts of China. Many settle permanently and a number have become successful merchants. The Indians supply most of the labor in the rubber plantations.

Singapore has about three-quarters of the trade of the Straits Settlements. The southwest of the island is hilly, but to the east it is flat and sandy or marshy. Most of the island is cultivated, being occupied by rubber plantations, coconut groves and market gardens. It is the seat of government of the colony. Penang is a rocky island rising to over 2,000 ft. in the center. The central part is still forested, but on the lower ground there are rubber and coconut plantations.

Malacca, Penang and Singapore were incorporated under one government in 1826, and under the control of the East India Company. In 1867 they were separated from India and made a crown colony. The settlement of Penang was afterwards made to include Province Wellesley and the Dindings, the latter including the island of Pangkor and a strip of the mainland. The Cocos Islands were placed under the government of the Straits Settlements in 1886, Christmas Island in 1889 and Labuan in 1907.

STRALSUND, a German city in the Prussian province of Pomerania, opposite the Island of Rügen in the Baltic Sea. The churches of St. Nicholas built in 1311, of St. Mary dating from 1416 and of St. James are of interest. There is also a medieval town hall with a museum. Founded 1209 Stralsund soon became a prominent Hanseatic city. It produces millions of packs of playing cards annually, also pianos, soap, varnish, shoes, machines and other articles. There is trade in fish, coal, grain, leguminous vegetables, wool and oil. Pop. 1925, 39,469.

STRALSUND, SIEGE OF. The first siege of Stralsund, a German seaport on the Baltic, occurred on July 5, 1628, during the THIRTY YEARS' WAR, when it was besieged by the Imperialists under ALBRECHT VON WALLENSTEIN. Except for a small garrison, the main defenders of the city were the inhabitants. After 11 weeks, Wallenstein had suffered a loss of 12,000 men and was forced to withdraw. Again, on Oct. 19, 1715, in the Dano-Swedish Wars, Stralsund was besieged and later captured by the Prussians and Danes.

STRAMONIUM, a drug consisting of the dried leaves and flowering top of the JIMSON WEED or thorn-apple, a poisonous narcotic plant of the night-shade plant. Stramonium yields not less than 0.25 per cent of the alkaloids of stramonium, similar to those from belladonna; medicinally it is considered as having no advantage over belladonna. Stramonium is sometimes an ingredient in so-called asthma powder. *See also* DATURA.

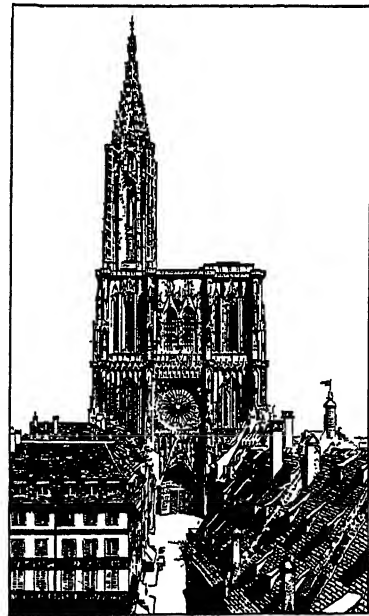
STRAND, THE, a busy thoroughfare in London, extending from Charing Cross to Fleet Street, its junction with the latter marking the boundary of the City. It was named Strand (meaning shore) because it crossed ground near the Thames River.

STRANGE INTERLUDE, a play by EUGENE O'NEILL which was produced in 1928. It is considered by many critics to be the greatest of American dramas. This work, unusual in that it contains seven acts, and plays for nearly five hours, introduces the dramatic device of having the actors express not

merely their outward, ordinary thoughts, but also those of their unconscious minds. The central theme is that of the influence which the passionate, neurotic Nina exercises on her husband, her lover and an older friend.

STRANGLES, a contagious fever peculiar to horses, especially colts. It is a specific infection caused by a microorganism (*streptococcus*) and is characterized by abscesses in the submaxillary lymphatic glands. The symptoms include fever, lassitude, cough, inflammation of the nasal membrane and such swelling between the branches of the lower jaw that food and water cannot be taken but are dropped from the mouth. The abscess increases until it finally comes to a head and bursts, freeing much pus, following which there is usually relief and recovery.

STRASBOURG, a city in France and capital of the department of the Bas-Rhin, situated 2 mi. west of the Rhine. Always of strategic importance Strasbourg was declared a free city in the 13th century and so remained for 400 years. In Sept. 1681 it was taken by Louis XIV of France who already held the rest of Alsace. Captured by the Germans after a siege in 1870 it was the capital of the German imperial territory of ALSACE-LORRAINE until the World War restored the two provinces to France. The Gothic cathedral possesses fine stained glass. Tanning and brewing are among the chief industries. Rouget de l'Isle composed the *Marseillaise* in Strasbourg in Apr. 1792. Pop. 1931, 181,465.



WEST END OF THE CATHEDRAL OF STRASBOURG

STRASBOURG CATHEDRAL, or Münster, Strasbourg, France, a magnificent structure of red sandstone, with a tall and imposing façade. Although it was begun in the Romanesque period, the main body of the church is built in the pure French Gothic

of the 13th century. Choir, transepts and crypt are Romanesque. The beautiful Gothic nave was built between 1250 and 1275. The façade, which was begun in 1277, is adorned with elaborate tracery, rich sculpture and a splendid rose window, and the north tower of the west front is crowned by a noble spire, added after 1420. The general effect of height in the façade was augmented in the 15th century by the insertion of an upper story between the two towers. The Romanesque portal of the south transept, although it has lost many of its ancient statues, retains some remarkable sculpture of the 13th century. The majestic interior of the cathedral is especially notable for the superb effect produced by its broad windows, filled with excellent 16th century stained glass. The carved pulpit is an admirable work of the 15th century. In the right transept is found the celebrated astronomical clock of Strasbourg, built in 1838-42.

STRATEGY, in a wide sense the science of employing the political, moral, material, and armed strength of a nation to gain the objects of a war. This aspect of the subject has been called grand strategy. It includes not only the conduct of war, but the measures taken in peace to place a nation in a favorable position in the event of war. In a more restrictive, military sense the literal meaning serves fairly well as a definition, i.e., generalship or the science of the general. The close relation of strategy to **TACTICS** makes it advisable to define both terms together. Von der Goltz defines strategy as the science of directing armies; tactics as the art of leading troops. Wagner, in his *Organization and Tactics*, defines the two terms more precisely, "Strategy is the art of moving an army in the theater of operations with a view to placing it in such a position relative to the enemy as to increase the probability of victory, increase the consequences of victory, or lessen the consequences of defeat. Tactics is the art of disposing and maneuvering troops on the field of battle." Underlying all military art are a number of principles considered to have been proved by a mass of historical evidence. While they apply equally to tactics and strategy, tactics is ruled more specifically by methods based on the characteristics of arms which constantly change and effect corresponding changes in tactics. Strategy, on the other hand, stands solely on these principles and is unaffected by the factors which change tactical methods.

Military Strategy. All military efforts are directed toward the attainment of a definite objective. This is usually destruction of the main hostile army as offering the most decisive means of obtaining the objects of the war. The strategic blow, however, may not be aimed directly at the main hostile force. Conditions may be such that the occupation of a locality important politically or materially, will deprive the enemy of his power of resistance and thus effect his virtual destruction more speedily and at a cost far less than might be entailed by a direct blow.

Assumption of the initiative is an important principle of strategy. Taking the first step forces the op-

ponent to conform or fight at a disadvantage. Initiative implies the offensive. The offensive alone promises decisive victory; the defensive offers little more than a draw. Loss of initiative enforces the defensive. Once gained the initiative can only be retained by continued vigorous action. History furnishes numerous examples of victories turned into defeats through failure of the victor to retain the initiative and follow up his success with a relentless pursuit.

The principle of concentration of effort contemplates coordination of all means available to gain the objective. It includes massing the greatest strength possible in making the main blow, and calls for exercise of the complementary principle, economy of force, in executing subsidiary missions. Full concentration of effort is only possible when all the forces in the theater of operations are under one commander. Surprise is one of the most potent elements in war. Strategy seeks to employ it at every opportunity, while at the same time it carefully guards against its use by the opponent. Deception is the instrument of surprise; intelligence is the instrument of security against it. The measure of success of any military operation depends upon the extent to which the defeated side has been deceived as to its opponent's intentions and dispositions.

Upon mobility or maneuverability depends freedom of action. Without it an army is unable to grasp the initiative, to mass forces at a critical point, or employ surprise. The principal conditions inherent in an army that affect its mobility are lack of training, faulty equipment and unwieldy organization. An army's mobility and freedom of action is reduced or lost when its source of supply is interfered with or when it is hemmed in by geographical obstacles. Mobility is the Logistic element of strategy. E. D. P.

Naval Strategy. This phase of strategy comprises the art of the naval leader, the use of battle in war and all that goes on in the sea theater of war. It shows the best way leading to the sea conflict; it tells where and when one ought to fight. The command of the sea is desired. War is a political act and but part of the general policy of a state; therefore, that policy must govern the conduct of war, for out of it of necessity must flow strategy. Naval strategy is based on the science of fleet organization and tactics. From the permanent character of the general interest of nations, policy, which emanates from them, to be effective must be continuous and guide the acts of a state during peace or war. It follows that strategy is a factor during peace and must be practiced then as well as in time of war. From the very beginning of hostilities, the field of strategy includes all operations up to the actual sea contacts with the enemy.

The source of peace strategy to a greater degree even than of war strategy, is policy. Changes in policy during peace, due to changed political conditions and interests and to changed naval conditions, together with war preparations come slowly. Peace strategy has a greater permanent character. To determine naval peace strategy, comprehensive studies of policies,

one's own forces and resources, and the forces and resources of the probable enemy or enemies must be made not only by the naval forces of the government, but by the government as a whole.

These conclusions must be coordinated and reconciled and an estimate of the situation made in case of war. Following the two, strategic operations are required as an essential link between strategy and policy, viz., letters of instruction to military and naval forces, outlining a general strategic plan should one come. This allows both services, through the General Staff (*see* GENERAL STAFF CORPS) and the General Board (*see* GENERAL BOARD OF THE U.S. NAVY) to proceed with preparing their respective separate estimates, strategic plans, detailed war plans, letters of information, etc., and to make such essential war preparations as have previously been overlooked.

Once a war is on, information can not be given the same credence as previously. Information throughout contacts made by forces afloat is essential. Scouts in plenty are needed with a chain of communications to the guiding center. At the same time, naval communications must be denied the enemy.

Special types of vessels are needed for such duties; speed and endurance are necessary in a scout, and strength in screening types. The need for strong and numerous screening vessels before combat is shown by peace maneuvers. While lines of communication are important, yet a fleet in modern times is self-sustaining for a long period of time, particularly as regards food and clothing. Large supplies of fuel and ammunition are carried. For those afloat, secure bases are necessary, not only for the repair and fueling of the ships, but the rest of the crew from war strain. Selected temporary bases are required.

Only such disposition of forces is allowable as required to find, keep touch with, and evade or deceive the enemy. When battle is imminent every unit within reach must be concentrated in order that it may play its part. When two opposing naval forces contact, and approach begins, naval strategy ends and naval tactics comes into play. R. E. C.

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STRATFORD, city, capital of Perth Co., and port of entry, Ontario, Canada, pleasantly situated on the Avon River, about 90 mi. southwest of Toronto. Largely exporting the miscellaneous farming and dairying produce of its environs, Stratford also has several furniture plants, mills manufacturing woolen goods, flour and lumber, as well as railway repair shops. There are a collegiate institute and a provincial normal school located in Stratford. Pop. 1921, 16,094; 1931, 17,742.

STRATFORD, a town of southwestern Connecticut, in Fairfield Co., situated on the Housatonic River, 3½ mi. east of Bridgeport. It is on the New Haven railroad. Stratford is chiefly a residential district, although there are local manufactures of machinery, brake linings and airplanes. It was once the home of

William Samuel Johnson, who was the first president of Columbia College, now Columbia University, New York City. Among the institutions of the town are Samuel Johnson Academy and a public library. Pop. 1920, 12,347; 1930, 19,212.

STRATFORD-ON-AVON, a market town of about 11,000 inhabitants, on the river Avon, 8 mi. southwest of Warwick, in Warwickshire, England, famous as the birthplace of WILLIAM SHAKESPEARE. The town, built mainly on the west side of the river, is laid out with wide streets and contains many quaint half-timbered houses. Shakespeare's house, which has been national property since 1847, was originally a double tenement, the west part of which was John Shakespeare's dwelling, the east part his wool-shop. In the unfurnished west house, on the ground floor facing the street, is the room in which the poet was probably born. The east house is a Shakespeare museum containing portraits, relics, and early editions of the plays. Shakespeare's grave is beside his wife's at Holy Trinity, the fine 12th century parish church. New Place, once the residence of Thomas Nash and his wife, Elizabeth (Shakespeare's granddaughter), is now a museum. In the nearby Guild Hall is the grammar school which the poet attended. Anne Hathaway's cottage, the thatched home of Shakespeare's wife, is at Shottery, 1 mi. west of Stratford, and at Wilmcote, close by, is the cottage of his mother, Mary Arden. As the Shakespeare Memorial Theater, 1877, burned Mar. 6, 1926, the annual festival performances have been given in temporary quarters pending the building of the new theater. The Harvard House, 1596, the home of the mother of JOHN HARVARD, was presented to Harvard University in 1909 by Mrs. Edward Morris.

STRATHCOMA AND MOUNT ROYAL (Donald Alexander Smith) Baron (1820-1914), Canadian trader, banker, railway builder and statesman, was born in Forres, Scotland. In 1838 Smith went to Canada as an employee in the Hudson's Bay Company, and after a long service on the coast of Labrador was placed in the Montreal office as chief factor. He was afterward stationed in the Canadian Northwest, as resident governor and later chief commissioner. Smith headed the special commission which inquired at Fort Garry into the causes of the Red River Rebellion. In 1870 he became a Conservative member of the first provincial parliament of Manitoba; he was appointed to the Council of Northwest Territories, and represented Winnipeg and afterward Selkirk in the Dominion Commons. When dual representation was prohibited, in 1874, he resigned his seat in the Manitoba legislature, but remained in the Dominion parliament until 1882. Meanwhile he had become interested in westward expansion, particularly in railway building; he was interested in the Canada Pacific Company, and later was a leader of the syndicate which financed the construction of the Canadian Pacific Railway. He was knighted in 1886; served in the Dominion parliament as member for Montreal West, 1887-96; was elevated in rank in

1896; and from 1896 until his death was High Commissioner for Canada in London. He was president or director of a large number of Canadian banking institutions; built and endowed the Royal Victoria College at Montreal, and was identified with other benefactions to universities and hospitals.

STRATIFICATION, in geology, the natural division of **SEDIMENTARY ROCKS** into layers, called beds or strata. This is so characteristic of sediments that they are also called the stratified rocks. It is due to changes in the materials deposited, or in the conditions surrounding their deposition. Thus, swiftly moving waters will carry **SANDS** and deposit them as the stream loses its velocity, for example, where it empties into lake or sea. In times of slack water, however, the same river can transport and therefore deposit, only fine **SILTS**, producing alternations of coarse and fine strata. Interruptions in sedimentation also result in breaks, or bedding planes, in a series of sedimentary beds. Chemical precipitates, such as **SALT**, are stratified as a result of changes in the nature of the material precipitated, or its speed of precipitation. Strata usually form horizontally, but later disturbances of the earth's crust may tilt them, even to the vertical, or overturn them so that older beds are on top, instead of the younger ones. Some sediments are found naturally inclined, as those on the sloping faces of **DELTA**s, or on the irregularly eroded beds of turbulent streams, or piled by the wind on the sloping surfaces of sand dunes. The study of stratification is part of the science of **STRATIGRAPHY**. See also **GEOLOGY**; **SEDIMENTATION**; **DEPOSITS**; **PETROLOGY**.

STRATIGRAPHY, the branch of geological science which is concerned with the stratified or **SEDIMENTARY ROCKS**. It is primarily a descriptive science, and deals with the character, arrangement, succession and age relations of these rocks. In any region where sedimentary strata occur, alone or with **IGNEOUS ROCKS**, a knowledge of the order of their formation, or the stratigraphic sequence, is a prerequisite to working out the geological history of that area. In undisturbed regions the lower beds are the older, but where dislocations have been the rule, it frequently becomes necessary to rely on the stages of development shown by the **Fossil** fauna and flora to indicate the relative ages of the strata. A knowledge of **PALEONTOLOGY** is therefore necessary for the stratigrapher. Fossils are also of assistance in distinguishing marine from continental **DEPOSITS**, although this differentiation can often be made on the basis of the nature of the sediments.

In relating the beds of one region to those of another, not only the fossils must be noted, but the relative thicknesses of the strata, the nature of the sediments of which they are formed, called their lithologic character, their color, and their structures, such as porosity and **STRATIFICATION**, must be studied. Of equal importance are the breaks in the sequence of **SEDIMENTATION**, brought about, for example, by changes in the elevation of the land so that marine

deposits are succeeded by continental ones, or *vice versa*. Or deposition may cease because the area is elevated, and the sediments exposed to the forces of **WEATHERING** and **EROSION**, so that when renewed deposition occurs it is on this eroded land surface, thus producing a break known as an **UNCONFORMITY**. By means of such data it becomes possible to determine the conditions under which sediments were formed, whether marine or fresh water, near shore or in deep water, on land in arid or humid climates, to work out the order in which they were deposited, and to decipher their relationships with other strata elsewhere. See also **GEOLOGY**, **INDEX FOSSIL**, **PETROLOGY**.

The term, stratigraphy, is used by archaeologists for the description of the layers or strata of pebbles, sand or earth, in which weapons, implements, bones or other remains of human beings have been found. As an example may be taken the layers or strata in Le Mas d'Azil, a natural tunnel traversed by a river, north of the Pyrenees. Beginning at the lowest, the layers, with average thickness in inches, are: (1) gravel and earth, with hearths, perhaps **SOLUTREAN**, 60; (2) black earth and ashes with **MAGDALENIAN** flints, 30; (3) alluvial bed, 30; (4) black clay with Magdalenian remains, 12; (5) alluvial yellow silt, 50; (6) reddish bed, two skeletons, flints of Magdalenian type, 13; (7) ashes with white, red and gray clay, Azilian flints, painted pebbles, harpoons, bones, nuts, seeds, 14; (8) black clay, bones of modern domestic animals, **NEOLITHIC PERIOD** and **BRONZE AGE** remains, 36; (9) black clay with bones, pottery and implements of the **IRON AGE**. See **ARCHAEOLOGY**.

STRATTON, SAMUEL WESLEY (1861-1931), American physicist and educator, was born in Litchfield, Ill., July 18, 1861. In 1884 he graduated at the University of Illinois, where in 1885-92 he served successively as instructor of mathematics, assistant professor and professor of physics and engineering. He was a professor in the physics department of the University of Chicago from 1892-1901; director of the National Bureau of Standards at Washington, of which he was the founder, from 1901-23; and president of the Massachusetts Institute of Technology from 1923-30, when he became executive chairman. Stratton died in Boston, Mass., Oct. 18, 1931.

STRATUM, in geology, a layer or bed of sediments deposited in a more or less horizontal position, and of considerable horizontal extent compared with the vertical thickness. The deposit may be made by wind or water, usually the latter, such as **SAND** or **CLAY**, or it may be the result of organic agencies, as **COAL** or **LIMESTONE**. The material thus formed may be compacted into the stratified or **SEDIMENTARY ROCKS**, such as shale or sandstone. Sedimentary rocks are frequently tilted so that their strata are no longer horizontal, but have a **DIP**. The juncture plane between strata is a "bedding plane." See also **STRATIFICATION**; **STRATIGRAPHY**.

STRAUS, NATHAN (1848-1931), American merchant and philanthropist, was born in Rhenish

Bavaria, Jan. 31, 1848, and came with his parents to the United States in 1854. Settling in Georgia, he later moved to New York City, and on completing his education joined his father in business. He became a partner in R. H. Macy & Son, New York, and Abraham & Straus, Brooklyn, but in 1914 retired to devote all his time to philanthropic work. An earnest advocate of milk pasteurization, he established, maintained at his own expense for 18 years, and gave to New York, the city's first pasteurizing laboratory and distributing plant, and made similar installations in other American and foreign cities. From 1892 on he worked tirelessly and gave unstintingly to the relief of cold, hunger, want, and illness in New York and elsewhere, and from 1915 spent more than his income, annually, in this cause. He was also active in philanthropy in Palestine. He died in New York City, Jan. 11, 1931.

STRAUS, OSCAR SOLOMON (1850-1926), American jurist and diplomat, was born at Ottersberg, Rhenish Bavaria, Dec. 23, 1850. He was brought to the United States in 1854 and lived in Georgia until after the Civil War when his family moved to New York City. In 1871 he graduated from Columbia College and received his degree in law there in 1873. After several years of legal and commercial work for R. H. Macy and Co. and Abraham and Straus, he was appointed Minister to Turkey in 1887, and obtaining a reappointment, served in that position until 1900. From 1902-06 he acted as judge of the Permanent Court of Arbitration at The Hague and in the latter year was appointed Secretary of Commerce by President Roosevelt, retaining this position until 1909 when President Taft appointed him Ambassador to Turkey, a post which he resigned the next year. In 1912 he supported the presidential candidacy of Theodore Roosevelt, Straus being himself the Progressive Party's nominee for Governor of New York State. In 1915 he was chairman of the Public Service Commission (first district) of New York State. He was the author of numerous books, chiefly on historical and political topics. He died in New York City, May 3, 1926.

STRAUSS, JOHANN (1804-49), Austrian dance composer, was born at Vienna, Mar. 14, 1804. He played in the Lanner Quartet. In 1826 he organized his own band, attaining such success that he made tours, which extended to Paris and London. In London he was in great request at the fêtes celebrating Queen Victoria's coronation in 1838. He became bandmaster in 1834 to the Viennese City Militia, and conductor at the court balls. He composed more than 250 waltzes, galops, and polkas. He died at Vienna, Sept. 25, 1849.

STRAUSS, JOHANN (1825-99), Austrian music composer, sometimes known as "The Waltz King," was born at Vienna, Oct. 25, 1825. He was the son of JOHANN STRAUSS (1804-49). He conducted extensively throughout Europe, and in 1872 visited the United States. He was a complete master of the

field of light music, and among his admirers included RICHARD WAGNER, while BRAHMS publicly regretted that he was not the composer of the *Blue Danube Waltz*. In addition to his celebrated waltzes, he composed a number of operettas such as *Die Fledermaus* and *Cagliostro*. He composed nearly 500 works, short and long, abounding in grace and gaiety. He died at Vienna, June 3, 1899.

STRAUSS, JOSEPH BAERMANN (1879-), American engineer, was born at Cincinnati, O., Jan. 9, 1879. He was graduated from the University of Cincinnati in 1892. He was actively engaged in engineering in Chicago, Ill., after 1895, becoming president and chief engineer of the Strauss Engineering Corporation in 1904. He developed designs for notable bridges, and he originated the Strauss trunnion bascule bridge and the Strauss lift-bridge. He has been regarded as an authority on movable and fixed bridge design. Strauss designed and built the aéroscope at the San Francisco (Calif.) Exposition, 1915, and the portable searchlight outfits used by the United States Government and Russia, and he invented the yielding barrier used at railroad grade crossings.

STRAUSS, RICHARD (1864-), German music composer, was born at Munich, June 11, 1864. His father was Franz Strauss (1822-1905), a horn virtuoso, no relation to JOHANN STRAUSS, the waltz king. He studied with his father and F. W. Meyer, making his début as a composer at the age of 16, when his setting of a chorus from *Elektra* was performed by the Gymnasium he attended. The following year his first symphony was produced, and when he was only 20 the New York Philharmonic Orchestra played his second symphony. In 1885, at the age of 21, he became Hans von Bülow's assistant-conductor at Meiningen, and in 1886 he became assistant-conductor at the Munich Court Opera, remaining there three years, and returning to the post as conductor in 1894. Meanwhile he had traveled extensively in the Near East. In 1895 he conducted the Berlin Philharmonic Orchestra, in 1898 he became chief conductor at the Berlin Royal Opera House, and in 1908 was made general music-director. He first visited the United States in 1904, reappearing twenty years later as conductor of his own works.

As an orchestra virtuoso Strauss may be ranked among the supreme modern masters. In his later works, notably in his operas *Salome* and *Elektra*, the exquisite economy of his earlier scoring is in part abandoned for greater orchestral background. It nevertheless remains true, in view both of the technic he has maintained since 1900 and of the sheer inspiration of his earlier labors, that he has become the foremost composer of modern Germany. Among his major works should be cited: four symphonies (including the *Sinfonia Domestica*, 1904, and the *Alpensymphonie*, 1915); seven symphonic poems (in the order of their composition, *Don Juan*, *Macbeth*, *Tod und Verklärung*, *Till Eulenspiegel*, *Also sprach Zarathustra*, *Don Quixote*, *Ein Heldenleben*); about fifty songs, exceedingly fine lyrics; and the operas, *Guntram*,

Feuersnot, *Salome*, *Elektra*, *Der Rosenkavalier*, *Ariadne auf Naxos*, *Die Frau ohne Schatten*, *Intermezzo*, and *Helen of Egypt*, produced in 1928. In 1932 he was completing a tenth opera, *Arabella*.

STRAVINSKY, IGOR FEDOROVITCH (1882-), Russian music composer, born at Oranienbaum, near Leningrad, June 17, 1882. Destined for a legal career, he abandoned law for music at the age of 20 and studied four years under RIMSKY-KORSAKOV. In 1908 his *Scherzo fantastique* induced Sergei Diaghilev to commission him to write a ballet, and *The Fire Bird* resulted, followed in 1911 by *Petrushka*, *Le Sacre du printemps* in 1913, and the opera *Le Rossignol* in 1914. His choral symphony, *Symphonie de psaumes*, commissioned by the Boston Symphony Society, was first performed in 1931. Other compositions include *L'Histoire du soldat*, *Feu d'artifice*, *Le Faune et la bergère*, *Les Noces*, and a symphony in E-flat. Among modernistic composers he is generally recognized as the Russian leader in ultra-harmonic freedom.

STRAWBERRY, the common name for a genus (*Fragaria*) of low perennial herbs of the rose family. There are about 20 species native chiefly to the north temperate zone and the high regions of tropical South America, several of which are extensively grown for their fruit. They produce long slender runners, which root at the joints forming new plants, but are otherwise stemless; the trifoliate leaves and flower-stalks, bearing white or reddish blossoms in small clusters, rise from a short crown near the surface of the ground. The fruit is not a true berry but consists of a greatly enlarged fleshy receptacle, which turns red at maturity, bearing numerous seeds (achenes) on its surface. The strawberries most commonly grown consist of various races and hybrids of three species:

(1) The European strawberry (*F. vesca*) native to the Old World and northern North America, with flowers and fruits borne above the foliage and the seeds (achenes) on the surface of the ripe fruit. This is the source of the Alpine strawberries of Europe, part of the Everbearing strawberries and various white-fruited forms.

(2) The Chilean strawberry (*F. chiloensis*), found near the coast from Alaska to Patagonia, a stocky plant with the flowers and fruits beneath the foliage, the seeds (achenes) sunken in pits, and thick leaves bluish beneath. A form (var. *ananassa*) is regarded as the parent of most of the commonly cultivated strawberries.

(3) The Virginia strawberry (*F. virginiana*), found widely in North America, similar to the Chile strawberry but with the leaves thin and light green beneath. In the eastern United States this is the common wild strawberry, strains of which appear in numerous cultivated varieties.

Strawberry culture began in Europe about 500 years ago; the Virginia strawberry was introduced into English gardens in 1629 and the Chile strawberry was brought to France in 1715. In the United States strawberries constitute the most important small fruit

crop. Their culture, which now extends from Florida to Alaska, began in 1834 with the introduction of Hovey's strawberry.

A. B. J.

Cultivation. Because of their natural habit strawberries are grown in more ways than are any other fruits. During the second season, usually shortly after fruiting, established plants begin to produce runners one or several each. Under favorable conditions these take root within two weeks. Each runner may continue to extend, so six or more joints on each may take root before the close of the season. Runners that become established earliest generally make the strongest plants. All runners produce the same variety of fruit as the plants from which they developed so they are almost exclusively used for planting established varieties.

In home garden practice well rooted runners are often dug and planted during late summer and early fall. Under favorable conditions and liberal feeding they produce well the following season. In the South commercial planting is generally done in August or September for a winter crop. When only small numbers of plants are needed runners are often made to take root in small flower pots filled with earth and plunged rim deep near the parent plants. After abundant roots have formed the plants are set in newly prepared ground. This method confines the roots in small space and avoids their destruction when lifted for transplanting.

On a field scale in the North runners are dug and planted in early spring. During the first season they produce little or no fruit but are given clean cultivation and liberal feeding to make them (and their runners) produce abundantly the following year. With good care plants so handled may continue to bear for five or six years but since the first and second crops are usually the best and because it is less costly to develop new beds than to clean old ones, commercial growers generally plow up their beds after they have gathered only one crop.

The most popular commercial method of growing strawberries is by the matted row system, all the runners being allowed to grow. In modified form is the hedge row system, the runners extending beyond a strip 12 to 18 inches wide being cut off. To produce exceptionally large, high quality berries the hill system is popular, only the crowns, no runners, being allowed to develop. In this system the beds may last for several years.

STRAWBERRY, COMMERCIAL PRODUCTION, U.S. 4-Year Average, 1927-30

Division	Acreage	Production (1,000 Quarts)	% of Tot. Prod.
UNITED STATES	193,808	303,244	100.0
LEADING STATES:			
Louisiana	23,300	28,024	9.2
Missouri	22,620	23,609	7.8
Tennessee	16,183	23,303	7.7
Maryland	11,933	21,999	7.3
Arkansas	18,500	19,406	6.4
Nor. Carolina	6,155	15,378	4.9

Strawberries thrive on well drained, rich moist soils and during cool weather. Young plants—those that have not borne—give best results. They must be set no deeper than their crowns. If placed too deep they will rot; if too shallow, their roots will dry out and die.

M. G. K.

STRAWBERRY GERANIUM (*Saxifraga sarmentosa*), a hairy perennial of the saxifrage family resembling the strawberry in its running habit. It is a native of China and Japan, long cultivated as a window garden and conservatory plant and readily grown out of doors in mild regions. The plant bears round, heart-shaped, very long-stalked leaves, white veined above and reddish beneath, and slender flower-stalks, sometimes 2 ft. high, with numerous white flowers in an open panicle.

STRAWBERRY GUAVA (*Psidium Cattleianum*), a bushy shrub or small tree of the myrtle family, closely allied to the common GUAVA. The plant is a native of Brazil, named after William Cattle, a noted English horticulturist, and widely grown in warm regions, including southern Florida and California, for its fruit. It grows sometimes 25 ft. high with smooth oblong leathery leaves, solitary white flowers and purplish-red, somewhat strawberry-like fruit an inch or more long with a white flesh. See also GUAVA.

STRAWBERRY HILL, the small Gothic "castle" built by the author HORACE WALPOLE between 1747 and 1775, situated near Twickenham, Middlesex, 12 mi. from London. The Countess of Waldegrave added the west wing to the mansion, which was occupied after 1925 by St. Mary's Training College.

STRAWBERRY TREE (*Arbutus Unedo*), a handsome evergreen tree of the heath family, closely allied to the MADROÑA. It is a native of the Mediterranean region widely grown for ornament in mild climates. In cultivation it usually grows 10 to 15 ft. high with oblong glossy green leaves and white or rose-colored flowers, borne in autumn in nodding clusters, followed by showy, scarlet, berrylike fruits. Various species of SPINDLE TREE (*Euonymus*) are also called strawberry tree. See also EUONYMUS.

STREAM OF CONSCIOUSNESS, the flow of conscious states. Consciousness has been compared to a stream. Like a river it has its flow, its rise and fall in current. At times there are only little eddies or ripples in the stream of consciousness, at others a rising tide as in the swelling up of a violent emotion. WILLIAM JAMES first used the expression "the stream of thought" to characterize our mental life. Though sensations come and go and ideas pass in and out of consciousness, there nevertheless seems to be a continuity in the stream. The water in the river is never quite the same. The stream of consciousness is marked by its individual experiences, its particular sensations and its present feeling tone. But running throughout there is a continuity that makes it one's own stream in contradistinction to that of someone else. It is this stream that makes my self different from somebody else's self.

STREAM POLLUTION BY SEWAGE involves contamination by bacteria and unstable organic matter, rendering the water unsafe for use as a public water supply without special treatment, or the stream unfit for recreational and other uses. Often stream pollution makes the vicinity unhealthy. The effects vary with: 1. Ratio of dilution; 2. Strength of sewage; 3. Dissolved oxygen of the stream, and 4. Rate of re-aeration, which is a function of (a) temperature and (b) turbulence of the stream. If the oxygen demand of the sewage exceeds the supply from the stream, "deoxygenation" occurs, putrefaction begins, and destruction of fish life results.

The "oxygen balance" determines the propriety of SEWAGE DISPOSAL by dilution, if other uses of the stream are taken into account. Stream pollution by dilute sewage is common in the U.S. The resulting nuisance is a menace to living conditions. The remedying of this situation is engaging the efforts of sanitary engineers and health officers. W. W. H.

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STREAMS form the natural drainage of a land surface. A large river, such as the Mississippi, drains an area extensive enough to include districts widely different in climate and rainfall, so that its flow is to some extent independent of local variations in weather and not subject to sudden and violent changes. In smaller streams the flow is dependent on the rainfall on their CATCHMENT AREAS and its variations are incessant, no two years, nor cycles of years, being the same.

Measurement of stream flow are made by the use of WEIRS, floats and current meters. Records of stream flows covering a period of less than five years are of little value in estimating the quantity of water available for a public WATER SUPPLY unless such a record can be compared with longer records of similar WATERSHEDS. In general about 70% of the average, or "mean," annual flow can be utilized for water supply if reservoir capacity is provided equal to the mean annual flow.

E. E. W.

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STREATOR, a city of La Salle Co., Ill., on the Vermilion River, 52 mi. northeast of Peoria. Numerous railroads serve the city which is the trading and shipping center of a corn-growing district. There are also natural resources of coal, clay and shale. In 1929 the value of the manufactures was about \$6,000,000; the retail trade amounted to \$9,222,683. The discovery of coal about 1860 led to the development of a village which bore the names successively of Hard Scrabble, Unionville and Streator. It was platted in 1865, and incorporated in 1882. Pop. 1920, 14,779; 1930, 14,728.

STREET, a term applied to HIGHWAYS within towns or cities. The city acquires a highway EASEMENT by dedication, or through legal condemnation of such width as is necessary. Commonly the road-

ways are 26, 36, 56, 76 or 104 feet wide, providing for two lines of parked vehicles and 1, 2, 4, 6 or 8 lines of moving vehicles. Sidewalk spaces are from 8 to 20 feet wide, the greater width providing for tree planting. Streets with a planting strip 20 feet or more wide in the center and restricted to passenger vehicles are sometimes called "boulevards." In addition to use by traffic, streets also contain, beneath their surface, sewers, water and gas pipes, electric conduits and other underground utility property, the placement and repair of which makes it difficult always to maintain satisfactory paving.

Streets are built in the same manner as HIGHWAYS but work must be carefully organized so as to interrupt traffic as little as possible. The concrete is often "premixed" and hauled to the work ready to lay; quick hardening cement (*see* CEMENT) permits use by traffic two days after laying instead of two weeks, as formerly.

Street cleaning and repair is carried out by municipal departments. In congested districts, the daily clearing away of trash and manure is done by patrolmen with carts and brooms, but most cleaning is done by mechanical equipment. W. W. H.

STRENGTH OF MATERIALS is a most important factor in all construction. When the two forces acting on a material are in line but in opposite directions, the specimen is in TENSION, and lengthens. If the forces are acting toward each other, the specimen is in COMPRESSION, and shortens. If the forces are not in line but are parallel, the specimen is bent, or is in *flexure*, and part shortens through compression, while part lengthens through tension. Materials subjected to twisting are said to be in TORSION, a special case of SHEAR. It does not follow that a material having a high value with one method of loading will have high values in the others. Concrete, for instance, is strong in compression but weak in tension and flexure.

Also most materials within certain limits possess elastic properties, that is, they return to their original size and shape after a load has been removed. Within the "elastic" limit the change in length of a specimen is proportional to the amount of load applied. In determining the elastic limit, a specimen is loaded by a constantly increasing amount and the magnitude of the deformations measured at regular intervals. When the deformations are not proportional to the load, the ELASTIC LIMIT has been reached. For some materials, as, e.g., steel, just beyond the elastic limit there is deformation without any additional load being applied, or in some cases with less load. This is the YIELD POINT. If deformation readings are not being taken, the yield point may be noted by the dropping of the weighing beam, or by the dial hand of the pressure gauge not moving. After the yield point is passed, further deformations are produced only by greater loads. The ultimate strength of a material is taken as the load necessary to produce failure of the specimen. In some materials the rupture is violent while in others it is gradual. In

engineering design it is considered good practice not to load a material to more than one-half of its elastic limit.

Extensive tests on metals have shown that stresses which will not cause failure when applied a few times, may cause failure if applied many times. This type of failure is known as *fatigue*. *See* FATIGUE OF MATERIALS. It has also been established that when a material is not stressed above a certain amount, repeated stresses do not cause failure. The *endurance limit* is the stress below which failure is not likely to occur. *See also* MATERIALS TESTING; TESTING MACHINES.

E. E. B.

STREPSIPTERA, an order of tiny parasitic insects. The males have very small fore-wings, but relatively large, fan-like hind-wings. The females are sac-like, and have no wings; they live partly within the bodies of other insects such as wasps, bees and leaf-hoppers.

STREPTOCOCCUS SORE THROAT. *See* TONSILLITIS.

STRESEMANN, GUSTAV (1878-1929), German statesman, was born on May 10, 1878 in Berlin, the son of a beer merchant. He was educated at the universities of Berlin and Leipzig, specializing in philosophy, political science and economics. Stresemann early showed signs of great organizing ability, and at the age of 23 he became secretary of the Union of Saxon Chocolate Manufacturers. Two years later he helped found the League of Saxon Manufacturers, whose purpose it was to organize and improve the local industries.

As a member of the National Liberal Party, Stresemann was elected to the Reichstag in 1907. Ten years later, upon the death of Ernst Bassermann, he became head of the party, which, incidentally, included such leading industrialists as HUGO STINNES. During the war Stresemann often attacked THEOBALD BETHMANN-HOLLWEG for his weak policies, and clamored for a more vigorous prosecution of hostilities. In 1918 he reorganized his following as the German People's party which, although monarchistic in sympathies, was ready to support the republic in the interests of peace, national unity and good business. In the Weimar Assembly of 1919 he voted against the acceptance of the Peace Treaty. In Aug. 1923 Stresemann succeeded WILHELM CUNO as chancellor. The assignment was most difficult, since Germany at the time was seething with internal disorders, particularly in Bavaria, Saxony and Thuringia; and the Allied occupation of the Ruhr created further problems. Within less than 15 weeks the Government fell, to be succeeded by a new one under Dr. Wilhelm Marx. Stresemann, however, became foreign minister in the new cabinet. He retained this portfolio under all successive ministries until his death in 1929. His policy was simple and straightforward; reconciliation with France, and the readmission in good standing of Germany into the family of nations.

A mere catalogue of Stresemann's accomplishments as foreign minister suffices to establish his reputation

as the greatest of Germany's postwar statesmen. He discontinued the policy of passive resistance against the French and Belgians in the Ruhr; he was to a large extent responsible for the adoption of the Experts' or DAWES PLAN for reparations, with its resultant loan to Germany and evacuation of the Ruhr; he took a leading part in the negotiation of the LOCARNO TREATIES, 1925; he labored for the admission of Germany into the LEAGUE OF NATIONS, 1926; he welcomed the opportunity to bring about German adherence to the KELLOGG PACT; he fought for the acceptance of the YOUNG PLAN for reparations in 1929; and he secured a promise from the Allies that the Rhineland would early be evacuated. Stresemann was also heartily in favor of Briand's (see BRIAND, ARISTIDE) plan for Pan-Europa. It was due largely to Stresemann's gifted oratory and his personal charm that friendly relations were so soon reestablished between Germany and the former Allies. He had numerous opponents, both at home and abroad, but he was universally trusted and respected. In 1926 he, together with Briand and SIR JOSEPH AUSTEN CHAMBERLAIN, won recognition for their services in the cause of world peace by being awarded the Nobel Peace Prize. See NOBEL PRIZES. On Oct. 2, 1929, Stresemann saved the Muller Government from overthrow by a great speech defending its stand on an unemployment insurance law. Handicapped from early youth by serious illness, Stresemann literally worked himself to death. He died at Berlin Oct. 3, 1929.

W. C. L.

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STRESS. See ELASTICITY.

STRETCH MODULUS. See ELASTICITY.

STRETTO, an Italian term meaning literally a "drawing together." In musical EXPRESSION it indicates a hastening of the tempo, or an *accelerando*. With reference to the FUGUE, it signifies a drawing together of the various voices; that is, an overlapping of the subject and answer during the concluding portion of that species of COUNTERPOINT. Although the actual tempo is not increased, more rapid movement is simulated by this accelerated imitation of the voices.

STRICKLAND, WILLIAM (1787-1854), American architect, was born at Philadelphia in 1787 and in his youth studied architecture under BENJAMIN LATROBE, architect in charge of the construction of the national Capitol. Some years later he moved to Philadelphia where he erected the Academy of Natural Science building, the old Mint, and, perhaps his most famous building, the Old Merchants' Exchange, a work which illustrates Strickland's adaptation of Greek motifs to the needs of buildings of his day. Strickland likewise interested himself in engineering problems, constructing one of the earliest railroads in Maryland and the Delaware breakwater, and writing numerous professional papers upon problems of canals and railways, papers which secured his election to

the Royal Society of Civil Engineers. Two of Strickland's later buildings are the Branch Bank of the United States, now the Court House, at Erie, Pa., and the State Capitol at Nashville, Tenn. During the construction of the latter he died at Nashville in 1854.

STRICT CONSTRUCTIONISTS, those who maintain that the Constitution of the United States should be construed with strict literalness, in opposition to those who, construing the Constitution broadly, have claimed for the National Government powers which are not granted specifically. THOMAS JEFFERSON, the prototype of strict constructionists, denounced the broad construction views of ALEXANDER HAMILTON. His followers in Congress opposed the enactment of Hamilton's recommendations, and from this conflict over the manner of interpreting the Constitution emerged the first political parties in the United States. The Democratic party has generally but not consistently advocated strict construction.

STRIKE, in mining and in geology, refers to the general direction or course, of an ORE DEPOSIT, VEIN, DIKE, or of the stratification in the case of tilted SEDIMENTARY ROCKS. The direction is measured in the horizontal plane, which is not the same as that shown, for example, by an OUTCROP on a sloping surface. Dip and strike are always mutually perpendicular. To "Make a Strike" in mining means to find rich ore.

STRIKE, a collective suspension of work by two or more employees for the purpose of maintaining or raising wages or working standards. Strikes for the maintenance of existing standards are sometimes called defense strikes, strikes for their improvement attack strikes. Other types are sympathetic, outlaw and general strikes. Although these terms are loosely used a sympathetic strike may be described as a stoppage by a group of workers, who without specific grievances against their own employers, wish to aid other workers on strike in the same, cognate or alien industries; an outlaw strike, as a stoppage by a usually militant minority in defiance of union authority; and a general strike, as a local or country-wide cessation of work by the majority of workers in the important industries of a community. General strikes may have political or economic objectives. Political general strikes may be of a legal, reformatory character or extra-legal and revolutionary in purpose. Strikes may be local, regional, national or even international in scope. Local and regional strikes are most numerous.

The legality of strikes in the United States depends generally upon the presence or absence of malicious intent. Strikes in good faith, having purposes which the courts believe legally justified, such as a raise in wages, shorter hours or better working conditions, are legal. Judicial opinion as to what purposes justify and, still more, what activities may accompany the strike is not uniform. In some states strikes for the closed shop (see CLOSED and OPEN SHOP), against nonunion materials or to procure the discharge of nonunion workmen are considered unlawful. The decisions often are inconsistent within the same jurisdiction. Even when the strike is called

for a purpose considered lawful, activities, such as PICKETING or BOYCOTTING necessary to make it effective, are illegal in some jurisdictions.

Strikes are as old as the wage system. In Europe they date back to the 14th, in America to the middle of the 18th century. With the progressive development of the machine process, modifying relations between industrial groups and making possible the emergence of groups of workers capable of concerted action, strikes have assumed an increasingly important rôle. Except for a marked but possibly temporary decrease since 1923, strike statistics covering the half century since 1880 show that the frequency of strikes, and the number of workers involved in them, have increased both absolutely and relatively to the number of industrial workers in the country; the average duration of the stoppages has also greatly increased. Differences regarding wages and hours, union recognition and the closed and preferential union shop (*see* LABOR ORGANIZATIONS) are the chief causes. A very large proportion of them occur in irregular and seasonal industries like the building trades, in which workers must earn enough during busy seasons for their maintenance throughout the year.

Public opinion in regard to strikes has undergone a change. Although it is realized that strikes are always regrettable, it is now more widely recognized than ever before, that in an industrial system characterized so much more by autocratic than by democratic and constitutional controls, they are often justifiable. The frequency of strikes wantonly called in the absence of real grievances seems on the decline. But where grievances are present oppression and injustice are likely to be also and these are likely to persist, especially so if the industry has set up no machinery for conference, COLLECTIVE BARGAINING or ARBITRATION. Strikes serve to ventilate such situations and, sometimes, to end them. P. F. B.

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STRIKE, GENERAL, a strike of the wage-earners in all the more important industries and occupations, in a given locality or nation. The strike may be either for an economic or for a political purpose. Since a strike of this sort, in so far as it succeeds, paralyzes all essential activities, it is a two-edged weapon, which injures its participants as well as the rest of the community. The theory of the general strike as a revolutionary weapon has played a large part in radical literature, especially the syndicalist (*see* SYNDICALISM). According to this theory, since only the workers know how to operate industry, if they withdraw their energy, the existing industrial and political control must collapse. The workers may then set up their own industrial management or government. A variant of this theory is, that while the revolutionary general strike may not be practical and may never occur, the idea of the general strike is a necessary myth to give the workers a sense of power. The general strike is not necessarily revolutionary either in intent or in effect. It may be called merely as a demonstration in behalf of a particular reform. Though com-

paratively few general strikes have occurred, it is possible to draw tentative conclusions concerning them. A brief and limited general strike may be effective in gaining a specific end, especially if the justice of the demand is already well supported in public opinion. Some general strikes have failed because of poor preparation. A general strike which is not promptly successful in gaining its end is likely either to fail altogether or to lead to a revolutionary situation. Whatever its intent, the interruption of essential services which it causes will either lead the government to attempt to force the furnishing of these services and break the strike, or compel the workers to seize political and economic control in order to furnish them. Resistance to general strikes on the part of government through organizing others than wage-earners to perform the essential tasks, is more successful than might have been imagined. General strikes have occurred in Great Britain, Germany, Belgium, Sweden, Holland, Russia, Spain, Italy, Seattle and Winnipeg. G. S.

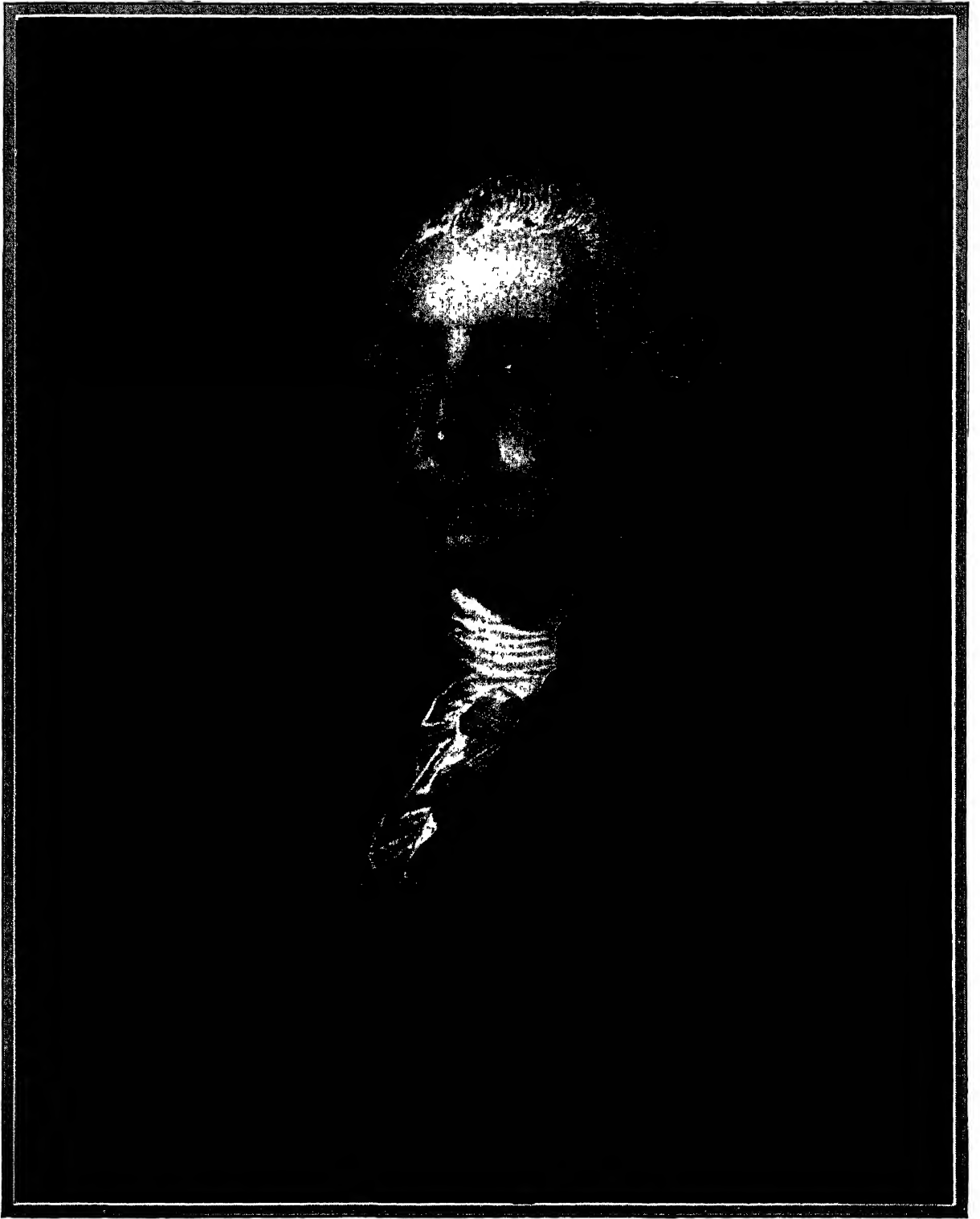
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STRINDBERG, AUGUST (1849-1912), Swedish novelist and dramatist, was born at Stockholm, Jan. 22, 1849. His father was a merchant, and his mother was a barmaid. His childhood was unhappy, and all through his life he was morbidly sensitive and irritable, so much so that at times he was not far from insane. He entered the university at Upsala, but owing to poverty was able to remain only two years, during which he supported himself by tutoring, journalism and odd jobs. His first literary success came with *The Red Room*, a realistic novel of artist life in Stockholm. For about eight years Strindberg was employed in the Royal Library at Stockholm, and it was while he held this post that he married his first wife, Siri von Essen, Baroness Wrangel. The marriage was unhappy owing, at least in part, to Strindberg's insane jealousy, and they were eventually divorced. Strindberg afterwards told his story of this marriage in *The Confession of a Fool*. Two other marriages followed the first and each ended in divorce. In several of his books, and particularly in *Married*, he expressed his opinion of women and marriage and revealed himself as a violent woman-hater. Strindberg's views on religion, politics, social questions and literature veered from one extreme to the other, and in consequence his writings of one period are often diametrically opposed to those of another period. He wrote poems, novels, historical studies, scientific works and much controversial literature, but it is as a dramatist that Strindberg's fame endures. The most important of his plays are *The Father*, *Miss Julie*, *Master Olof*, *The Dance of Death* and a series of dramas based on the history of Sweden. He died at Stockholm, May 14, 1912. I. A.

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STRIPES, an expression applied to CHEVRONS worn by uniformed members of the Army or Navy to de-

STUART



"GEORGE WASHINGTON"

By Gilbert Stuart (1755-1828). Painted in 1803, this is probably the best known of the Stuart portraits of Washington.
In the Metropolitan Museum of Art.

note the wearer's grade or rank, his war service, or the fact that he has been wounded in action against an enemy. Service stripes are prescribed marks of distinction in the form of a stripe, worn, toward the end of the left sleeve, by an enlisted man to indicate extended honorable service: one stripe for each period of three years of such service.

STRIP MINING, a mining method used where overburden covers comparatively thin beds of ore. One cut of overburden is removed at a time and the underlying ore mined. The dirt from each cut is dumped into the previous cut. In another sense, strip mining is sometimes used underground where a separate rich streak of ore occurs. In order to prevent the rich ore from becoming mixed with the poorer material, the latter is worked out first over a given length, and the rich streak broken down separately afterwards.

STRIPPING, in mining, refers to OPEN PIT methods of excavating COAL and ORE DEPOSITS, in which the overburden, or waste material covering the deposit, is removed, or "stripped," before the mineral itself is extracted. The deposit must lie fairly close to the surface to make this method an economical one. STRIP MINING is a special method of stripping. See also MINING, COAL; MINING, METAL.

STROBOSCOPE, an instrument employing the method of intermittent illumination in order to determine the speed at which a rotating body is revolving, or to study the form of the motion of a vibrating body, without having to disturb the moving body in any way.

In one form of stroboscope, the rotating body is viewed through a revolving disc having one or more radial slits or equally spaced lenses, and the speed of the disc is adjusted until some pattern painted on the rotating body remains stationary in space. The speed of the rotating body may then be determined from the measured speed of the disc. A vibrating body, such as a stretched cord, may be made to appear to be at rest by this same means, and, hence, the form of the wave traveling down the cord may be determined. Instead of the disc, a hollow cylindrical drum having two or more diametrically opposite slits may be used. The drum is rotated with its axis perpendicular to the line of vision, and the slits act as shutters.

Still another form of stroboscope dispenses with rotating discs or drums and illuminates the revolving body with light from a gaseous discharge, such as a NEON or mercury-vapor lamp, whose frequency of discharge may be adjusted by electrical means until the body is apparently at rest. T. S.

STROMBOLI, MOUNT, a volcano on the island bearing the same name, the most northeasterly of the Lipari Islands, which lie north of Sicily. For almost 2,000 years, the mountain, which rises 3,040 ft. above the sea, has been in a state of perpetual activity. From its crater on the northwest slope it ejects at very frequent intervals lava and clouds of steam, which, lit by the reflection of the fiery interior, are

visible for many miles and form a spectacular sight at night. In 1907 a very destructive eruption occurred.

STRONTIANITE, a minor ORE of strontium, usually found with other strontium minerals in veins associated with BARITE, GALENA and CALCITE. It is a pale green to yellowish brown mineral with a glassy appearance, varying from translucent to transparent. Strontianite is the carbonate of strontium, crystallizing in the ORTHORHOMBIC SYSTEM.

Strontianite is found in England and Germany and in the states of New York and Pennsylvania. Strontium is used in chemical industries. See also ORE DEPOSITS.

STRONTIUM, a metallic element (symbol, Sr, at. wt. 87.63, sp. gr. 2.54) of the calcium group found chiefly as a carbonate (strontianite) and a sulphate (celestite). The pure metal is silvery white, melts at 900° C. and decomposes in cold water. Strontium hydroxide, $\text{Sr}(\text{OH})_2$, is used in the extraction of sugar from molasses; the nitrate, $\text{Sr}(\text{NO}_3)_2$ is used in fireworks because of the brilliant red flame produced in burning; the chromate, SrCrO_4 , serves as a yellow pigment in paints.

STROPHANTHIN, a glucoside or mixture of glucosides, obtained from the seeds of the Kombe (*Strophanthus hispidus*), a South African climbing plant of the dogbane family; occurring as a white or yellow powder, having an intensely bitter taste. Its medicinal effects are practically identical with those of DIGITALIS. Because of its great toxicity, caution should be exercised in tasting it. It is administered intravenously or intramuscularly in doses as small as 0.5 mg. (1/120 grain).

STROPHANTHUS, a genus of trees and shrubs of the dogbane family comprising about 30 species, natives of Africa and Asia. The seeds of the climbing south African species *S. hispidus* yield the bitter glucoside strophanthin, with properties somewhat similar to digitalis, used in medicine as a cardiac stimulant, especially in nervous disturbances of the heart accompanying certain forms of goitre. In Africa various tribes prepare arrow poison from the seeds.

STROUDSBURG, a borough in eastern Pennsylvania, the county seat of Monroe Co., situated on Broadhead Creek, 28 mi. north of Easton. It is served by four railroads. Stroudsburg is a popular summer resort, beautifully situated at the foot of the Pocono Mountains, 3 mi. from the Delaware Water Gap, and surrounded by farming land. The local industries include silk and wool manufacture, mower and boiler works. A State Teachers College is located here. Stroudsburg was settled in Colonial times, and contains a number of fine old houses. The borough was plotted in 1806. Pop. 1920, 5,278; 1930, 5,961.

STRUTHERS, a city of northeastern Ohio, on the Mahoning River, about 5 mi. southeast of Youngstown. It is served by four railroads, and has an airport outside the city limits. Struthers is a residential section of Youngstown with large manufacturing interests, including steel and iron works, fence wire, wire nails, and iron pipes. The retail trade in 1929

amounted to \$2,615,274. Founded in 1800, Struthers was incorporated in 1902. Pop. 1920, 5,847; 1930, 11,247.

STRYCHNINE, a poisonous alkaloid (formula $C_{21}H_{22}O_2N_2$) obtained from the seed coats of *nux vomica*, an Indian tree of the logania family. It occurs as colorless crystals or white powder, extremely bitter in dilute solution, slightly soluble in water and in alcohol. Medicinally it is generally prescribed as *strychnine sulphate*, consisting of colorless or white crystals or a white crystalline powder, efflorescent in dry air and soluble in water. Strychnine and its salts stimulate the respiratory center and the activity of the spinal cord. Large doses raise the blood pressure and cause convulsions of spinal origin. Death may occur during a convulsion or during the interval from respiratory paralysis. Strychnine in very small amounts is employed as a bitter, either as a sulphate or in the form of tincture of *nux vomica*. Physicians use it at times in certain forms of paralysis and to improve the tone and nutrition of paralyzed muscles. It is also a "tonic" to the muscular system. P. N. L.

STUART (STEWART or STEUART), HOUSE OF, a family which occupied the throne of Scotland and later of England. The founder of the house was Alan, son of Flaad, a Breton, who came into England with William the Conqueror. His second son, Walter (d. 1117) became steward of Scotland under David I. The office was hereditary in the family for seven generations. Walter, sixth steward, married Marjory, daughter of ROBERT BRUCE, their son Robert (1366-1390) succeeding to the throne in 1371. JAMES I, his grandson, was famous as a lawmaker and author of the *Kingis Quair*. JAMES IV married the daughter of HENRY VII, introducing a claim to the English crown. On the death of ELIZABETH, James, son of Mary, Queen of Scots, succeeded to the English throne as JAMES I of England, uniting the two kingdoms in a personal union. The family was exiled after the execution of CHARLES I but returned in 1660 by the restoration of CHARLES II. The deposition of JAMES II in 1688 ended the reign of the male line, but his two sisters, MARY II (d. 1695) and ANNE (d. 1714), were the last Stuarts on the British throne. James II's son, James Edward, the Old Pretender (d. 1766), and his grandson, Charles Edward, the Young Pretender (d. 1788), still maintained their unsuccessful claims to the throne. The last male descendant of the Stuarts, Henry, Cardinal York, died at Frascati, Italy, in 1807.

STUART, ARABELLA (1575-1615), the central figure of royal intrigues prior to the death of ELIZABETH OF ENGLAND, was born at Chatsworth in 1575. She was the daughter of Charles Stuart, Earl of Lennox, and was next to JAMES I in succession to the thrones of England and Scotland. Supported by the group to whom James was unacceptable as Elizabeth's eventual successor, Lady Arabella had for suitors HENRY IV of France and the Earl of Northumberland. She was installed at Hardwick under a guard but succeeded in escaping in 1610 to marry William

Seymour, son of Lord Beauchamp. Both were imprisoned and both escaped in 1611. Arabella was caught and imprisoned in the Tower, where she became insane, and died, Sept. 27, 1615.

STUART, GILBERT (1755-1828), American portrait painter, was born at Narragansett, R.I., Dec. 3, 1755. His father, a Scotch snuff manufacturer, removed to Newport, where Gilbert met his first teacher, Cosmo Alexander, with whom he went to Edinburgh in 1772. Upon his return he executed a portrait of his grandmother from memory and other work which attracted the attention of the wealthy families of Newport. In 1775 Stuart went to London, where at first he earned a living as an organist. He entered the studio of Benjamin West in 1778 and four years later established his own studio. Recognition from the fashionable world was rapid, and Stuart executed portraits of the Prince of Wales, the Duke of Northumberland, Reynolds, Gainsborough and John Kemble. Although he obtained good prices for his work he was obliged to flee to Dublin because of debts and to pay his passage to America by painting the ship's owner. In 1795 Stuart opened a studio in Philadelphia and achieved his wish of painting a portrait of George Washington. He later moved to Washington and thence to Boston. Stuart's European portraits have a pearly gray tonality and a delicate precision of brush work; his American portraits, of which the most famous is the *Athenum*, Washington, show a use of pure color which anticipates modern methods. Stuart died at Boston, July 27, 1828.

STUART, JAMES EWELL BROWN or "JEB" (1833-64), Confederate general, was born in Patrick Co., Va., Feb. 6, 1833, and graduated from West Point in 1854. With the outbreak of the Civil War he joined the Confederate cavalry, receiving the rank of colonel. Rapidly winning promotion, Stuart made a successful raid on Chambersburg, Pa., and guarded Lee's retreat after Gettysburg. In the Wilderness campaign he led the cavalry and won several engagements, but in May 1864 he tried to stop Sheridan near Richmond, Va., and was killed at Yellow Tavern, May 12, 1864.

STUART, MARY. See MARY QUEEN OF SCOTS.

STUBBS, WILLIAM (1825-1901), English historian and prelate, born in Yorkshire, June 21, 1825. He graduated from Oxford in 1848 and was ordained two years later. In 1862 he was appointed librarian at Lambeth, and was regius professor of modern history at Oxford from 1866 to 1884. He was a Broad Churchman and a friend of the laborer, as evidenced by the fact that when a vicar he cut his glebe land up into acre allotments. In his scholarly work Stubbs devoted himself chiefly to the study of English constitutional history during the formative period prior to 1485. His *Constitutional History of England* in three volumes, of which his *Select Charters and other Illustrations of English Constitutional History* is a companion piece, is the point of departure for all subsequent work in English Constitutional

history; his editions of numerous chronicles for the *Rolls Series* are among the very best in the series. With Haddon he published three volumes entitled *Councils and Ecclesiastical Documents Covering the History of the Anglo Saxon Church*. Some three volumes of his lectures have been collected and published. He was made bishop of Chester in 1884 and of Oxford, 1889. He died in 1901.

STUCCO, a plaster of varying composition applied to outside or inside walls and their ornamentation, and to other articles of interior or exterior decoration. A fine quality is made from gypsum, sometimes with the addition of marble dust; but the finest is made of powdered chalk mixed with water and size. For outside walls a satisfactory stucco mixture is one composed of one part of portland CEMENT to three parts of sand, to which may be added hydrated lime equaling 10% of the weight of the cement. These materials are mixed dry until the mix is uniform in color. Water is then added to give the required plasticity and the "batch" re-mixed until the mortar is uniform in consistency. The stucco may be stained in the mixing, or calcimined, oil-painted or gilded after being applied. Graffito decoration is often seen on Italian walls, consisting of two or three coats of different colors, superposed, cut through to reveal the underlying layers, as in a cameo. The Greeks and Romans used stucco extensively, molding it into exquisite relief designs. The ancient Egyptians, 4,000 years ago, used a plaster still hard and durable. Their calcined gypsum was just like our own plaster of Paris, and occasionally the relief forms were overlaid with gold leaf.

Wonderfully beautiful architectural effects were obtained very inexpensively by the use of staff, a sort of stucco mixed with coarse fibers, for the exterior of the Exposition buildings in Paris in 1878 and Chicago in 1893.

STUPA, a Buddhistic religious monument of solid masonry enclosing, or erected over, some religious relic. The stupa is obviously a masonry development from a tumulus, and is usually circular in plan, and conical, convex or domed in outline. Thus the famous Shwe-Dagon, or Golden Pagoda, in Mandalay is in essence a central stupa surrounded by many subsidiary ones. In China the stupas were of great richness and of many different types. One common form, in which Lamaist influence is marked, is tall, round, domed, and often tapers downward slightly to give a bulging silhouette. The whole is often crowned with a series of disks and a metal finial, and built upon a great terrace. Another form, especially common in the neighborhood of Peking, is square, generally pyramidal, and decorated like a PAGODA with tiers of decorative roofs. Sometimes several types are combined in one composition, as in the Marble Pagoda, 18th century, at Pi Yun Sze, near Peking.

STURGEON, the common name for a family (*Acipenseridae*) of ganoid fishes of high economic value. They have a long spindle-shaped body, protected by a tough skin armored with five rows of bony plates, and a cartilaginous skeleton. The upper

lobe of the tail is usually much larger than the lower (heterocercal). The sucker-like, toothless mouth is situated beneath the much elongated snout. Sturgeons are among the largest of living fishes, ranging in length from 2 to 30 ft. and sometimes weighing 2,000 lbs. There are about 30 species, widely distributed in rivers and seas, the marine species ascending streams to spawn. They are of sluggish disposition and feed chiefly on worms and other small animals found in the mud at the bottom; they lay immense numbers of very small eggs, a single female sometimes depositing 3,000,000 in a season. Sturgeons are much used for food, the flesh of all species being marketed both fresh and smoked in very large quantities. The roe forms the caviar of commerce and the inner coat of the air bladders is manufactured into isinglass. The most important North American species is the common sturgeon (*Acipenser oxyrinchus*), formerly abundant on the Atlantic coast from New York to Carolina, sometimes 10 ft. in length and weighing 500 lbs.

Other species are the white sturgeon (*A. transmontanus*) of the Pacific coast, the largest of American sturgeons, now very rare, and the lake sturgeon (*A. rubicundus*) of the Mississippi valley, the Great Lakes region and northward.

STURGEON BAY, a port city in northeastern Wisconsin, the county seat of Door Co. It is situated on a peninsula between Green Bay and Lake Michigan proper, 40 mi. northeast of the city of Green Bay. Steamboats and the Green Bay and Western Railroad serve the city. The traffic of the harbor in 1929 amounted to \$74,531,500. The city has shipbuilding, fishing and milk industries, and it is the site of a state fish hatchery. Sturgeon Bay is a popular summer resort and the region is celebrated for its cherry orchards. Pop. 1920, 4,553; 1930, 4,983.

STURGIS, RUSSELL (1836-1909), American architect and author, was born at Baltimore, Md., Oct. 16, 1836. He was graduated from the College of the City of New York in 1856, after which he studied architecture in Europe. His practice of this profession was curtailed by ill health and he turned to writing on art and architecture. Among his important publications are *European Architecture*, *The Appreciation of Sculpture*, *The Appreciation of Pictures*, a *History of Architecture*, and a *Dictionary of Architecture and Building* in three volumes. Many of his monographs were published in leading periodicals. After 1885 he was active in art societies in New York and lectured extensively on art subjects. Sturgis died in New York, Feb. 11, 1909.

STURGIS, a city in St. Joseph Co., southwestern Michigan, situated 40 mi. south of Kalamazoo. Airplanes, bus lines and two railroads afford transportation. The district is fine farming country, producing fruit and grain. The principal manufactures are furniture, curtain rods, credit system books and brass products. There are many charming lakes in the vicinity. Sturgis was founded in 1827; chartered in 1896. Pop. 1920, 5,995; 1930, 6,950.

STURM, JOHANNES (1507-89), German educator, was born near Cologne, Oct. 1, 1507. He was educated at Leyden and Louvain, and from 1529-36 lectured in Paris. The next year he began the reorganization of the educational system at Strasbourg and inaugurated methods which made that city one of the most important educational centers of Europe. Sturm established in 1537 the Strasbourg Gymnasium, where he worked out a new system of gradation of classes for secondary schools; and in 1564 founded the Strasbourg Academy for higher studies. His great success was based on his ability to correlate public instruction to the intellectual development of the age. Sturm died in Strasbourg, Mar. 3, 1589.

STURM, JULIUS (1816-96), German poet, was born at Kostritz, July 21, 1816. In 1850 he was pastor at Goschitz, and from 1857-85 held a similar post at Kostritz. Of a truly pious character, his religious feeling led him to much soul-searing analysis which is reflected in his unassuming verse. Among Sturm's works are *Fromme Lieder*, 1852, *Für das Haus*, 1862, *Von der Pilgerfahrt*, 1868, *Gott grüße dich*, 1876, *Aufwärts*, 1881, *Dem Herrn mein Lied*, 1884, *Psalm und Krone*, 1887, and *In Freud und Leid*, 1896. He died at Leipzig, May 2, 1896.

STUTTERING. See STAMMERING.

STUTTGART, capital of the German state of WÜRTTEMBERG lying in the valley of the Neckar River about 38 mi. southeast of Karlsruhe. It is surrounded by hills covered with vineyards and orchards, upon which the urban expansion has somewhat encroached. Its climate is characterized by mild winters and warm summers. The old city, with its crooked streets, surrounds the market place and the rathaus. Thirteen suburbs including Cannstatt, were merged with Stuttgart between 1903 and 1929.

Of the 55 churches, the most noteworthy are the Stiftskirche, St. Leonard's Church and the Hospital Church, all of the 15th century. The most prominent of the secular buildings are the old castle, the new castle, the orangerie, the former crown prince's palace, the rathaus and the theater. There are more than a dozen squares and ten parks and parkways. Stuttgart is one of the most important industrial cities in south Germany and is the south German center of book-publishing. The factories, located in some of the suburbs, manufacture machines, precision instruments, iron and metal goods, paper and food products. A technical school heads the numerous and diversified educational institutions which, together with many libraries, museums, art galleries, orchestras and learned societies, make Stuttgart an important cultural center. Particularly valuable are the art collections. Pop. 1925, 343,048.

STUYVESANT, PETER (1592-1672), Dutch colonial governor, was born in Scherpenzeel, Southern Friesland, in 1592. He was educated at Franeker. From 1634-1635 to 1644 he was director of the West India Company's colony at Curaçao. He lost a leg in action in 1644. In May 1645 Stuyvesant was appointed director of New Netherland, arriving in New

Amsterdam May 11, 1647. His administration was marked by conflict with the burghers. In Sept. 1647 he appointed nine representatives chosen by the people to consult with him and his council. Upon the suggestion of the States-General the first municipal government for New Amsterdam was established in 1653. In 1650 at a meeting at Hartford Stuyvesant came to an agreement with the commissioners of the New England colonies upon the question of disputed boundaries. In 1664 Charles II granted the territory between the Connecticut River and Delaware Bay to his brother, the Duke of York, and Col. Richard Nicolls was sent to take possession of New Amsterdam. The burghers refused to support Stuyvesant's measures for defense, and the town and fort were surrendered Sept. 8. Stuyvesant subsequently secured free trade between Holland and New York. He died in New York, Feb. 1672.

STYE, or HORDEOLUM, a mild infection of the eyelids, caused by pus-forming bacteria. The mouths of one or more of the modified sebaceous glands opening on the rim of the eyelids, tarsal or Meibomian glands, are affected. A sty begins as a small, tender, red swelling along the margin of the lid. In several days it turns white at the top. This white region is the pus, which must be freed by a nick with a sterilized scalpel. The pus is immediately absorbed in cotton and a drop of mercuriochrome placed on the lesion. Boric acid baths prevent the infection of neighboring glands. See also EYE, DISEASES OF.

STYLIST, one who advises merchants, manufacturers and consumers on the trend of the market and the choice of purchases. It is the stylist's business to predict public demand while answering its immediate requirements. Independent stylists work with wholesale houses, department stores, specialty shops and designers, advising them on what products should be bought or created to insure the largest possible market and the greatest profit. Stylists connected with organizations may also advise customers as to the suitability of purchases. A thorough knowledge of the market is necessary, as well as an understanding of public taste and style value. Since organizations make their purchases on the advice of the stylist, the success of an enterprise, as well as the personal success of the stylist depends entirely on accurate judgment.

STYX, in Greek mythology, the chief river of the lower world, which it surrounded. It was a branch of Oceanus. When personified, Styx was the daughter of OCEANUS and Tethys and dwelt in a grotto at the entrance to Hades. It was the water from the Styx which IRIS used to lull the gods who had perjured themselves to sleep, and also the water by which the gods swore.

SUB-ATOMIC ENERGY. The nuclei (see NUCLEUS) of the elements are, in all probability, built up of PROTONS and ELECTRONS closely bound together. The ALPHA PARTICLE, or HELIUM nucleus, contains four protons and two electrons in an extremely stable

formation. If four protons and two electrons, isolated from each other, could be brought together to form helium, a certain amount of energy would be left over. For one atom of helium this would be a very small amount, but for, say, one gram of this gas, it would be equivalent to 250,000 h.p. for an hour. The form in which this predicted sub-atomic energy would be radiated is unknown to-day.

The alpha particles emitted from the nuclei of certain radio-active elements (*see* RADIOACTIVITY) possess highly concentrated stores of energy. Their rate of production cannot, however, be controlled, nor are they sufficiently numerous, in view of the rarity and excessive cost of the elements, to serve a useful purpose.

J. B. H.

SUBCONSCIOUS refers to phases of the mental life that do not rise to clear conscious awareness. We become aware of feelings and sensations only so far as is necessary and helpful to our behavior; we become aware of our breathing only enough to regulate it. Similarly, digestion goes on subconsciously, and circulation decidedly so. Yet all organic conditions contribute to mood and general well-being. It is in the special field of mental direction that the problem of the subconscious arises. Walking is originally a deliberate step-by-step, balancing, progressing accomplishment; in a few years the child walks subconsciously, that is with reduced attention, semi-automatically. Some persons walk in their sleep, others talk in their sleep, and talking is a far more elaborate psychic function than walking, though carried on with smaller muscles. It is the organization of the subconscious supports to our conscious processes that determines how we shall regard the subconscious phases of our mental structure. We readily understand how we commit ingrained habits, such as using a typewriter or a sewing machine, largely to subconscious guidance. At first conscious, these manipulations have become automatic, second nature, yet decidedly with some conscious direction; only the subsidiary habits are reduced to a subconscious status.

The theory that the subconscious is independently organized, that we have an objective and a subjective mind, or even a **SUBLIMINAL** self may be dismissed. It is plain that no one has ever subconsciously learned to play the violin or to speak a language and surprised his conscious self with this accomplishment. It is quite true that we learn a number of partial bits of behavior with partly suppressed consciousness; they remain in the indirect fields of awareness. Our muscles know where to reach for the door-knob, high or low, right or left, in a familiar situation; when we raise a pitcher which we supposed to be full of water and find that it flies up in our hand because it is empty, or try to take an extra step at the head of a stairway, we subconsciously inferred that the pitcher was full or that there was an additional step for which we prepared a proper muscular response. These lapses as well as absent-minded mis-handlings are explained. They represent the usual mechanisms of subconscious support.

The problem of subconscious operation in the more special sense arises in connection with some measure of **DISSOCIATION** which is already present in a markedly absent-minded action. When one attempts to wind his watch and finds that he has already done so, but has forgotten it presumably because he was distracted when winding it, the first winding failed to register; when he tries to recall where he may have mislaid a lost article, he is in a sense placing his conscious self on the trail of the subconscious.

When a man carries an umbrella under his arm in a rain, because he is so certain that he had forgotten it that he is unaware of its presence, the abstracted state is deeper. But it is only when that state approaches the still more abnormal that it may be called a trance, in which the relation between what is done and recalled in the one condition and what in the waking state displays the degree of organization of the subconscious in some readily dissociated persons. It is always a question of degree of dissociation. But the records of hypnosis, of trance states assumed for mediumistic purposes, as well as of somnambulism, show an amazing power of conducting operations in a dissociated state. These complications appear still more remarkably in dual or multiple personalities (*see* PERSONALITY) in which certain ranges of experiences are organized around one phase of personality, and others under another, with conflict and perplexing relations between them. These states have given rise to a theory of the subconscious which recognizes co-conscious states as well. In this view the hysterical person maintains two series of awareness, two psychic systems side by side, with occasional and peculiar relations between them, alike of communion and distinctness.

That such phenomena appear on an hysterical basis suggests that instead of the unified conscious organization of powers and memories which most of us achieve, there arises a divided sovereignty. How this proceeds is not clear. It seems to imply that the entire repertory of acquisition which we exercise normally only in the waking state may, in certain peculiarly disposed neurotic persons, be exercised in another than the normal state. The two sets or systems of acquisition may remain fairly independent.

The Freudian Subconscious. The views of the subconscious were profoundly affected by the novel theories of Freud (*see* PSYCHOANALYSIS), who finds in all of us a large reservoir of subconscious operations, which are in part the suppressed memories of early childhood, in part repressions of incidents which we would exclude from memory as unpleasant, and in part an assembly of primitively subconscious trends associated with instinctive urges of all kinds, of a sexual origin particularly. This area or content Freud calls the unconscious, and in later writings the **Id**. It represents the most primitively organized portions of our psychic endowment. According to Jung, it represents racial ancestral memories, a reservoir or deposit of racial experiences.

The unconscious is a basic concept of Freud's system. What is ordinarily called the subconscious, the supporting or surrounding fringe of feelings, memories, ideas that may by effort be brought within the conscious field, Freud calls the fore-conscious. The unconscious is made up of material out of range and reach of ordinary effort, but which may be brought forward by psychoanalysis, or in hypnosis, or emerge in dreams, all of which tap the deeper sources of our psychic nature. The unconscious is broader than the unacknowledged or suppressed. It consists, according to Freud, mainly of infantile, childhood trends, those of a sexual nature above all, which cannot be lived out in the actual life. This energy source is called libido. The neuroses result from unresolved complexes suppressed into the unconscious, and are relieved when their source is discerned.

Whether or not expressed in the terms of Freud's theory, a large part of the psychic life is, in the familiar figure of the iceberg, submerged below the visible field; there is the great mass below supporting what appears above the horizon. Our motives and in part the content of our thoughts which reach expression have a deeper origin than the reflection which is their conscious representation. The material of this subconscious activity is largely emotional, instinctive, and may send its roots far back in the personal past while yet affected by the desires of the present. Theories of the subconscious may seek the source of these trends in the neurograms or neurological patterns. They may find them of purely psychic nature as does Freud; or they may be conceived as psychoneurograms, as does Morton Prince, with the possibility that on a neurological basis a psychic elaboration is constructed. The issues of subconscious activity are variously recognized. Their part in determining neuroses forms the very nucleus of Freud's theory. The neurosis is a conflict between repressed, frustrated subconscious trends and the conscious, socially imposed life. Specific incidents suppressed in the subconscious, and persistent fixations there nurtured, develop complexes. Subconscious activities shape beliefs and prejudices as well as moods. Alike in the normal and abnormal life, there is a great reservoir of primary function, sending its roots deep into what we may call the primary subconscious, which constantly affects the secondary functions which constitute the conscious life. This relation, however complex, must be thought of in naturalistic terms; the basis of it must be provided in the nervous organization. The psychic life is an integration of conscious and subconscious functions. J. J.

See J. Jastrow, *The Subconscious*, 1906; M. Prince, *The Disso- ciation of a Personality*, 1906, and references under **PSYCHO- ANALYSIS**.

SUBDOMINANT, in music, a tone a fifth below the tonic, as opposed to the dominant which is a fifth above the tonic or key-note. Next to the tonic and dominant, it is the most important degree of the musical scale. Being the fifth below the tonic, it also is the fourth above it and hence is just below the fifth

or dominant; in the scale of C-major, F is the sub- dominant, being a fifth below the tonic C, a fourth above C, and a major second below G, the dominant.

SUB-IRRIGATION. See **IRRIGATION**.

SUBJECTIVISM, a theory holding that we can know only our conscious states; that the knowledge of a thing is necessary to its existence. The first position is best represented by the scepticism of DAVID HUME, the second by the subjective idealism of Bishop GEORGE BERKELEY (1685-1753). The two may easily be combined. In its extreme form subjectivism becomes solipsism.

Hume argued that it was possible to know only one's perceptions. Even the principle of causality was nothing but a customary relationship between perceptions. The mind could never arrive at an idea of substance. Thus the two chief conceptions in metaphysics were denied by the subjectivism of Hume.

Berkeley thought that things existed only in their being perceived. Their *esse* was in their *percipi*. Primary qualities were reduced to the same status as secondary. If color and sound had no existence apart from the knowing subject the same was true of motion and extension. The impenetrability of matter was as much a subjective state as was a tooth-ache. With Hume's denial of Berkeley's spiritual substance, subjectivism declined.

SUBLIMATION, a process in which a solid, when heated, passes directly into the gaseous state without melting. Sublimation is accompanied by the absorption of heat which keeps the temperature below the melting point. All solids theoretically give more or less of vapor, but only those which are volatile as iodine, arsenic, chlorides of iron and aluminum, etc., sublime at a noticeable rate. Sublimation is used in separating certain substances from their ores.

SUBLIMINAL SELF, a term used in explanation of SUBCONSCIOUS phenomena, by assuming two orders of consciousness: one the conscious reflection that directs behavior, and the other a subconscious or subliminal self that manifests itself in a variety of ways. Such a subliminal self was assumed by Thomas Jay Hudson (1893) who referred to its activity hypnosis, clairvoyance, trances of mediums and mental cures. He held that man had two minds, the objective which operates under ordinary conditions, and the subjective which proceeds by intuition, by telepathy, and transcends the recognized powers of the senses. The term "subliminal" was introduced by F. W. H. Myers (1903) in far more scientific form as an explanation of a similar range of phenomena in *Human Personality and its Survival after Bodily Death*.

With the detailed study of subconscious phenomena by students of ABNORMAL PSYCHOLOGY and the special place assigned it in the system of Freud (see **PSYCHO- ANALYSIS**), this hypothesis comes in conflict with the organization of subconscious activities in the support of ordinary perception, memory, imagination and association, as well as in the accounting of its failure and disintegration in trance and hypnosis and **DUAL PER-**

SONALITIES. Few psychologists hold to the concept of a subliminal self, though the organization of the subconscious activities is variously set forth. Morton Prince, in *The Dissociation of a Personality*, presents a typical theory. J. J.

SUBMARINE, a naval vessel capable of being submerged up to the limit of safety and fitted with self-propelling machinery; also fitted with TORPEDOES fired from underwater tubes. The aiming of the submerged torpedoes is handled by means of a PERISCOPE, which is used when attack is to be made on surface craft.

Submarines are a matter of evolution and have been vastly improved. In the early years of the 17th century, the submerging boat propelled by oars was invented and other attempts at similar vessels were made by France and Italy. Repeated efforts were made for the next 150 years. David Bushnell, of Connecticut, designed a one-man submarine torpedo boat to remain below the surface one hour. Its efforts were unsuccessful. Robert Fulton was enthusiastic, but failed in his projects.

In Feb., 1864, occurred the sinking of the Housatonic by a Confederate submarine boat, while on blockade duty off Charleston, S.C. A spar torpedo was used. The boat was propelled by a screw worked by eight of her crew of nine men. Her speed was four knots in smooth water and her hull was made of boiler iron. However, a heavy sea swamped the attacking vessel, with loss of all hands.

France and the United States continued to experiment until finally each nation perfected a submarine which it was felt could be used in warfare.

From single hull for small craft, gradually double hulls were used for large vessels; watertight divisions were perfected. The tanks used were cleared by pressure, and submarines were in a state of light positive buoyancy.

On the upper deck is the navigation bridge for surface use and the conning tower, with passage to the interior, built around the bridge and periscope. DIESEL ENGINES are now used. From the time of perfection of the submarine, surface warships have become better equipped to withstand attack, particularly by the use of extra compartments and BLISTERS. Merchant vessels are practically all vulnerable.

After 1914 the two classes of submarines were the patrol and coastwise submarines, not exceeding 80 tons. Then by rapid advances, came on the fleet submarines with a cruising radius of 18,800 miles. The usual later types are the general service, triple tube, with good surface and submerged speed, high endurance, guns, and good seagoing qualities.

Under the LONDON TREATY, the United States, Great Britain and Japan are limited in 1936 to 52,500 tons of submarine each. In 1932 the United States had 96 submarines, built and building, under 13 years of age; British Empire, 67; Japan, 71; France, 102, and Italy, 79.

The submarine force of the United States fleet is one of the component parts of the fleet and is under

the command of a FLAG OFFICER. At the height of the German submarine warfare, 430 vessels of 852,000 tons were sunk in the month of Apr., 1917. R. E. C.

SUBMARINE AND CHEMICAL WARFARE TREATY, an agreement devised by the WASHINGTON CONFERENCE, signed Feb. 6, 1922, by the signatories of the FIVE-POWER NAVAL TREATY. Belligerent submarines were declared "not under any circumstances exempt" from established rules (redefined in the treaty) of international law for the protection of neutrals and noncombatants at sea in time of war; and "if a submarine cannot capture a merchant vessel in conformity with these rules the existing law of nations requires it . . . to permit the merchant vessel to proceed unmolested." The signatories accepted as binding between themselves the prohibition of the use of submarines as commerce destroyers, and invited other Powers to incorporate this prohibition as part of the law of nations. Asphyxiating, poisonous, or other gases and analogous liquids or devices, "having been justly condemned by the general opinion of the civilized world," were prohibited, and other nations were invited similarly to outlaw their use.

SUBMARINE DIVING is often involved in repairing and salvaging operations on ships, on repairs to underwater structures, and with subaqueous foundation construction. The diving apparatus consists of a head helmet having glass windows to look through; a plate covering chest and back (onto which the helmet is screwed); a flexible air- and water-tight suit with tight legs and closed feet, open hands and tight wrists; weighted shoes to overcome buoyancy; air hose connected to helmet; and regulating valves. Heavy underwear is worn under the suit. Air is fed to the diver by hand-operated pumps or from compressed air flasks. The diver is raised and lowered and signals are transmitted by means of a "life" rope. In deep diving landing stages are sometimes suspended beneath the surface so that descent and ascent may be made gradually, and recompression chambers are provided at the surface, to prevent "bends." See CAISSON DISEASE. The work is extremely difficult but may often be facilitated by special aids and tools for under water work, such as electric lights, telephones, pneumatic tools (see PNEUMATIC POWER TRANSMISSION), acetylene cutting torches, and hydraulic jets for excavating.

Depths to which divers may descend have rarely exceeded 300 feet. The practicable maximum for which continuous and efficient work is considered to be less than 100 feet. See also DIVING BELL; CAISSON.

F. R. H.

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SUBMARINE MINES. See MINES.

SUBMARINE OPERATIONS. The initial German submarine success in the WORLD WAR was the sinking of the British light cruiser *Pathfinder* by the U-21, off the Scottish coast, on Sept. 5, 1914. In 1915-16 German submarines sank an increasing number of Allied supply and neutral ships, including the

Lusitania, torpedoed May 7, 1915, with the loss of 1,198 men, women and children. In 1917, faced with an apparent deadlock on land, and with her navy still blockaded by the British Grand Fleet, Germany inaugurated an unrestricted submarine campaign, which historical perspective shows nearly starved out England. On the other hand Germany's submarine operations and Zimmermann Note in 1917 to the effect that she would resume submarine activities on an unrestricted scale beginning Feb. 1 was a principal and an immediate cause of the entry of the United States into the war. The submarine sinkings were only partly nullified by the system of convoy ships to guard transports and supply vessels, mines, nets, depth-bombs and the Q-Ships, or armed merchantmen. During the World War the U-boats sank a total of 5,408 ships of all classes, excepting naval vessels, belonging to the Allies and neutrals, representing 11,189,000 gross tons. Allied anti-submarine measures sank 203 German submarines.

SUBMARINE SIGNALLING, a method of communicating under water, consisting of devices fastened on the under water portion of a ship, which send out sound waves. These waves can be picked up by another vessel, if equipped with a suitable receiving set.

SUBMARINE TELEGRAPHY, the transmission of telegraph signals by submarine cable. The development of efficient "under-water" transmission dates from the introduction of effective insulation materials in the middle of the 19th century. The first successful cable was put into operation between France and England in 1851 and since then cables have been laid linking the important centers of the world. The first permanent Atlantic cable was laid between Ireland and Newfoundland in 1866 although previous attempts had been temporarily successful. These first cables were operated on the simplex system of one-way transmission with a sensitive galvanometer as the receiver. Later, the development of the duplex system and the automatic recorder greatly increased the speed of transmission.

The duplex system is almost universally used in submarine transmission. By it, signals may be transmitted from both ends at the same time, the apparatus responding only to signals from the opposite end of the cable. The receiving apparatus consists essentially of a galvanometer which reacts to the minute pulses of current and an ink recording mechanism which registers the pulses detected by the galvanometer. This set-up provides a printed record of the transmission. For long-distance cables, it is necessary to amplify the incoming signals before detection. This is commonly done by the use of vacuum tube amplifiers. See also MORSE CODE; TELEGRAPH.

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SUBOTICA. See SUBOTITSA.

SUBOTITSA, also known as Subotica and Maria Theresiopel, a city of the former Vojvodina, YUGOSLAVIA, close to the Hungarian frontier and con-

nected by rail with Budapest, about 110 mi. to the north. It is a widely spread town lying in a rich fertile plain between the Danube and the Theiss. It is close to the popular resort, Lake Palics. Surrounded by a farming district abounding in corn and tobacco, Subotitsa is also a trading center for cattle, and manufactures linen, shoes, furniture and railway trucks. Under Hungary a royal free city of the county of Bacs, it was incorporated in the kingdom of Yugoslavia after the World War, when its name was changed from Szabadka to Subotitsa. Pop. 1931, 100,058.

SUBPOENA, an order of a court demanding that a person be present at a court action under a penalty for failure to attend. A writ demanding only the presence of the person is termed a *subpoena ad testificandum*; one demanding that the person bring with him certain documents and papers is called a *subpoena duces tecum*. Failure to answer a subpoena makes a person liable to CONTEMPT OF COURT proceedings and may make him liable to civil suit for damages.

SUBSOILERS, a type of plow designed to break the subsoil to provide a large root zone for plants and to cause the ground to retain more moisture. The walking type resembles a walking plow without a moldboard, having instead a sharp piece of steel with a shoe at its lower end. The power subsoiler is mounted on wheels.

SUBSTANCE, the essence or nature of a thing; that which stands under, or that in which the attributes inhere. The first conception is Greek; the second that used in modern philosophy.

With ARISTOTLE the concrete embodiment of a universal is its substance. Nevertheless Aristotle's tendency is to locate the essence at the point of complete realization rather than in the process of realization itself.

RENÉ DESCARTES recognizes two substances, mind and matter. The materialist recognizes but one fundamental substance, as does the idealist also. In either case the substance of a thing is its unchangeable element. With BARUCH SPINOZA substance is that which exists by itself and is sufficient unto itself. It has the two attributes of thought and extension. Substance itself does not appear to the senses but is manifested through its attributes. JOHN LOCKE stressed a distinction between primary and secondary qualities of substance. GEORGE BERKELEY eliminated the necessity for a material substance by showing that the primary qualities are on exactly the same plane as the secondary. DAVID HUME went beyond this and denied spiritual substance as well. From him the importance of this metaphysical conception received its deathblow and has never since revived.

SUBTRACTION, the operation of finding by how much one number exceeds another. In the case of $25 - 8 = 17$, the minuend, or number to be diminished, is 25; the subtrahend (*sub*, under, + *trahere*, to draw) is 8, and the difference, also called the remainder, is 17. There are various ways of considering sub-

traction. We may think of (1) taking 8 away from 25; (2) finding what must be added to 8 to make 25; (3) adding 2 to 25 and then taking away 10, 2 being equal to 10 — 8. Of these, the first is the one most commonly used.

SUBWAY, a term meaning, in the United States, an underground railway for city rapid transit. Also it applies to a buried "bank" of conduits for electric cables, to an underground gallery for cables, pipes, or movement of freight, and to a short passage for crossing on foot under streets, railroads and the like. In large cities where great numbers of people require high-speed transport for long distances, subways are preferred to elevated railroads wherever the advantages of quietness and unencumbered streets outweigh the greater cost. Subway lines are frequently extended into suburbs by elevated or surface lines.

The actual beginning of city underground transit was at London in 1863. It is a comparatively shallow line, but subsequent lines, the first of which was put into service in 1890, are generally at such depths that station lifts are necessary, and consist of a pair of cast-iron tubes driven by shield in the London clay. Operation at first was by steam.

With the development of electric traction, subway progress followed rapidly. In 1896, at Budapest, the first electrically operated subway was opened. Its form of construction, with flat roof close to the pavement and supporting columns between tracks, was the precursor of the design later adopted in the U.S. In 1897, the Glasgow District cable operated subway was opened. The first subway in the U.S. for the use of trolley cars was built in Boston. The first section of the Paris subway was opened in 1900, and the first section of the Berlin subway in 1902. In 1900 the New York City subway was started and was opened in 1904. The Philadelphia subway was opened in 1907, that at Hamburg in 1912, at Buenos Aires in 1913, at Madrid in 1919, at Sydney in 1926, and at Tokio in 1928. By 1931 nearly all subways in operation had been extended and new ones were projected.

Foreign subways are generally smaller in cross-section than those in the U.S., corresponding to smaller cars, although several use track of standard gauge. Practically all are limited to two tracks.

New York City Subway System is the largest, comprising 74 miles of subway and tunnel operated by two different companies. New lines under construction are expected to add over 60 miles eventually. Main trunks have four tracks; the inner pair for "express," the outer for "local" trains. Branches generally have two tracks. Most of the subway is rectangular in section, consisting of steel frames set at regular intervals.

Ventilation problems arising in the first summer of operation, led to the addition of air-outlets between stations in portions subject to heaviest travel, and to sidewalk openings, covered by gratings, alongside station platforms. Large ceiling fans in the cars serve to alleviate discomfort due to heat and crowding,

rather than to vitiated air. Walls between tracks in some sections aid in promoting ventilation by the "piston" action of train movement. On the *Interborough* lines express trains of ten cars, each 51 feet long, are run on two minutes' headway during rush hours. Cars of the Brooklyn-Manhattan lines are 67 feet long.

Travel on all rapid transit lines averages over 5,500,000 passenger-trips daily. Alternating current is generated in central stations at 11,000 volts, and is transformed and converted in sub-stations to reach the contact rails as direct current at 625 volts. Trains are operated by "multiple-unit" control.

The New York City subway system is municipally owned and financed for construction, and is operated under lease by the companies, who own the equipment. With the new lines now building, the combined cost of lines and equipment is not far from \$1,000,000,000. F. C. N.

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SUCCESSION, ACT OF (1701), an act of Parliament which decreed that all future kings of England should be Protestant. See HOUSE OF WINDSOR; PROTESTANT SUCCESSION.

SUCCESSOR STATE, a state formed out of or gaining territory from another state that has passed out of existence. After the World War, Czechoslovakia, Yugoslavia, Poland and Rumania were recognized as successor states to the dismembered Austro-Hungarian Empire. Although required to make "contributions toward the Allied cost of liberation" they were relieved from the payment of REPARATIONS.

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SUCCINITE. See AMBER.

SUCKER, the common name for a family (*Catostomidae*) of fresh-water fishes allied to the carps but differing chiefly in the sucker-like mouth which is usually provided with thick, fleshy lips. There are some 60 species, all found in North America except two which are native to Siberia and China. They range from 6 in. to 3 ft. in length and are dull in color with few markings, although the males of some species develop in spring black or red pigmentations on the body or fins. Suckers are usually of sluggish habit and are found on or near the bottom of streams, lakes and ponds, feeding upon various aquatic plants, insects and small animals which they take in by suction. Although their flesh is inferior, suckers are speared or snared for food in large numbers when ascending shallow streams in the spring.

Of the typical suckers, the best known is the white sucker (*Catostomus commersoni*) found in nearly all streams east of the Rockies. It attains a length of 18 in. and is locally important as a food fish. The northern sucker (*C. catostomus*) is the most widely distributed, ranging from the Great Lakes and St. Lawrence westward and northward to Alaska.

The Buffalo fishes (*Ictiobus*), the largest members of the family, of carplike appearance, abounding in

large rivers and lakes, are of considerable commercial importance in the Mississippi valley. Other well known suckers are the black horse (*Cycleptus*) of the tributaries of the Mississippi and Ohio, and the red-horse (*Moxostoma* sp.; *Placopharynx* sp.). The total catch of suckers in the United States in 1929 was 6,868,000 lbs., valued at \$338,000. *See also* BUFFALO FISH; REDHOUSE.

SUCKING FISH, a name sometimes applied to species of REMORA, slender, pelagic, spiny-rayed fishes which attach themselves, by means of a sucking disk on the head, to other fishes and are carried about for great distances.

SUCKLING, SIR JOHN (1609-42), English poet, was born at Whitton, Middlesex, and was baptized there Feb. 10, 1609. He was educated at Cambridge, studied law and spent several years on the Continent in Gustavus Adolphus's army. About 1632 he returned to England where he became identified with the court as a wit and man of fashion. He presented his drama *Aglaura* in 1637 with great display; two years later he led a gorgeously caparisoned troop of horses to Scotland with Charles I and sat in the Long Parliament. Little of his work was published during his lifetime; but a collection appeared in 1646. His fame rests upon his lyrics, among which are *I prithee, send me back my heart* and *Why so pale and wan, fond lover?* His verse is light and graceful, dealing usually with pleasures of sense rather than of spirit, and the poet is sometimes compared with ROBERT HERRICK. Implicated in the plot to free Strafford from the Tower, Suckling fled to France, and is believed to have taken poison. He died at Paris, in May or June, 1642.

SUCRE, ANTONIO JOSE DE (1795-1830), South American general and statesman, born in Venezuela. At the age of 15 he joined the independence movement as a lieutenant of engineers, serving first with Marino, and, in 1814, when Marino joined Bolivar, receiving the commission of lieutenant colonel. By 1818 he had attained the rank of general, and Bolivar sent him to the Antilles to gather arms and reinforcements. His most notable contribution came after 1821 when he was in command of the army of western Colombia, designated to aid Guayaquil, which he succeeded in liberating. In the same year he won the battle of Pichincha and destroyed the Spanish army in Ecuador. He next served in Peru, where he won the battle of Junin, and in 1824, at the battle of Ayacucho, he broke the power of Spain in South America and assured the independence of the continent from Spain. For these services he received the title of Marshal of Ayacucho. When the Republic of Bolivia was formed in 1825, Sucre was given charge in the name of Bolivar, who had been elected chief executive, and in 1826 he became president, and served for two years. In 1830 he presided over the constitutional convention of Colombia. He was assassinated in June 1830. Next to Bolivar, Sucre is considered the most important figure in the northern wars for independence.

SUCRE, the legal capital of Bolivia, situated in the department of Chupuisaca in a valley 9,330 ft. above sea level, which gives the city a healthy climate, averaging 56° F. Sucre is about 105 mi. by rail northeast of Potosi, the largest city of Bolivia. It is well-built, with broad streets, and contains the University of St. Francis Xavier, founded in 1624, said to be the oldest university of South America. The cathedral, which dates from the middle of the 16th century, was once famous for its wealth. Sucre was founded in 1529 by one of Pizarro's companions. Pop. 1930, 35,181.

SUCROSE, or SACCHAROSE. A twelve carbon disaccharide probably composed of the two six carbon monosaccharides, beta-glucose and beta-levulose. The particular forms of DEXTROSE and LEVULOSE which have united to form sucrose are not known exactly. It is the *sugar* of widest commercial distribution, although of very recent commercial acceptance in the world trade. The source of commercial sugar is from sugar cane, sugar beets and to a very minor extent from the sap of certain trees and palms.

The two component sugars, dextrose and levulose, may be obtained by the action of dilute acids or inverting enzymes. Sucrose forms simple salts known as saccharates with the alkaline metals and more complex saccharates with the alkaline earth metals. It is oxidized to oxalic acid. (*See also* CARBOHYDRATES.

Sucrose is manufactured from *sugar cane* and *sugar beets*. The early steps in the manufacture are somewhat different, but in handling the refined liquors the processes are similar. *See also* SUGAR: Processes of Production and Chemistry of Sugar. W. B. N.

SUCTORIA. That order of insects to which fleas belong is sometimes designated as *Suctoria*. However, the term *Siphonaptera* is used more commonly. These are small, wingless insects, with laterally compressed bodies. The adults are very agile. Mouth parts are fitted for piercing and sucking. Metamorphosis is complete. Adults are parasitic upon mammals, occasionally upon birds. Larvæ are slender, worm-like creatures that feed on decaying vegetable materials.

SUDAN, THE, a name applied to the region of central Africa which is bounded on the north by the Sahara, south by the countries draining to the Congo basin, west by the Atlantic and east by Abyssinia, Eritrea and the Red Sea. Geographically, the term may be said to include all the territory of central Africa west of the Nile; politically, the only tracts to which the name is applied are the Anglo-Egyptian Sudan and the French Sudan, a colony of French West Africa. The rule of Egypt in the Sudan ceased when the Dervishes held the country from 1885 until 1898. Anglo-Egyptian and French expeditions set out to recover the country and in 1899 the Dervishes were overthrown.

Anglo-Egyptian Sudan. This territory is under British authority and has an area of 1,008,100 sq. mi.

It includes a long stretch of the Nile from Nimule to Wadi Halfa, all the drainage from the Congo divide, part of the upper drainage of Lake Chad, a large part of the Libyan desert, the lower courses of all the Abyssinian tributaries as well as the deltas of the Gash and Baraka rivers which run from the northern edge of Abyssinia. The coral-fringed coast line is on the Red Sea, and is of vital importance despite its being desert. Political boundaries are Egypt and Libya to the north, Belgian Congo and Uganda to the south, Abyssinia and Eritrea to the east and French Equatorial Africa to the west.

The population was estimated at 5,579,776 in 1929. It has rapidly increased since the suppression of the Mahdi despotism and the preceding slave trade with Arabia. The varied and unevenly distributed population includes Arabs in the north, Negroes in the south and mixed races in the middle zone.

In the summer season considerable rain falls in the southern savanna lands where cattle are raised and some wild coffee grown. Charcoal burning is extensively carried on in the forests here. The main crops, millet and cotton, are produced in irrigated districts of the north. Peanuts and sesame are cultivated in considerable quantity. Gum arabic held the leading position among the products of the region until 1924, when cotton took first place in export values. The Sudan produces about 70% of the world's supply of gum arabic. Great Britain and the United States are the leading purchasers of this commodity, the export value of which exceeds \$4,000,000 annually.

In recent years important irrigation schemes were carried out so that in 1930 an area of 630,000 acres was open to cultivation between the Blue and White Niles; one-third of this district was under cotton. The necessary water is stored at the Sennar Dam, completed in 1925 and situated about 170 mi. south of Khartoum. Cotton, which was first introduced experimentally in 1911, gives promise of being the great staple of the Sudan. It is the dominating crop despite the gradual change in climatic conditions to the south and a certain amount of political antagonism between the British and Egyptian interests, exemplified by the break in the railroad following the Nile valley. The Nile is used as a commercial link, and the cotton exports from Port Sudan on the Red Sea reach their market mainly by way of the Suez Canal, which is within Egyptian territory. There is no through connection by rail with Egypt.

Camels from the northern provinces, live cattle and sheep are exported to Egypt. The stock includes about 1,500,000 cattle and 5,750,000 goats and sheep. Ivory from the south finds a market in London. The mineral wealth includes salt, of which there is a considerable output near Port Sudan, and a small quantity of gold worked at Gabait.

The principal towns are KHARTOUM, the administrative center; OMDURMAN, the old Dervish capital; EL OBEID, an important market center; Wadi Halfa, an important frontier station; and PORT SUDAN, on the Red Sea. Despite modern development camels and

donkeys are considerably depended on for transport.

In addition to the vernacular schools, there are primary schools where instruction is given in English as well as Arabic. Gordon College at Khartoum offers vocational training and has a secondary school. There are also technical institutions here and at Omdurman and Atbara. The territory is divided into 15 provinces, administered by a governor-general, aided by a nominated council. Native administrative officers are employed under the council.

French Sudan, has an area of 360,331 sq. mi., chiefly a savanna zone with a fairly large amount of summer rainfall. The upper part of the Niger River, assisted by its tributary Bani, causes the inundation of the Timbuktu region, creating an inland sea normally covering about 20,000 sq. mi.

Modern irrigation was introduced in 1929. In the watered areas, rice is a summer and wheat a winter crop, and there are plantations of sisal and kapok. Peanuts, raised chiefly in the Gambia and Senegal River valleys, provide the chief export. Large numbers of cattle and sheep are kept and donkeys and camels are raised for transport. Alluvial gold is found.

Bamako, with 17,186 inhabitants, is the administrative center of French Sudan. TIMBUKTU, pop. 6,118, is an oasis town that has lost much of its importance with the decline of trans-Saharan traffic and the slave trade. Communications are largely dependent on the Niger and the Kulikoro-Bamako-Kayes railroad to Dakar on Cape Verde promontory. There are regional or urban schools in all the chief towns.

French Sudan was formed in 1904 from the territories of Senegambia and the Niger, the protectorate of SENEGAL being under separate administration. The old name of the colony was Upper-Senegal Niger, and was changed to French Sudan in 1920. The territory is under the governor-general of French West Africa. In 1927 the population was 2,632,618, about 500,000 being nomads.

SUDAN GRASS (*Holcus sudanensis*), a tall slender sorghum-like annual, closely resembling JOHNSON GRASS. It is a native of Africa extensively cultivated for hay in semiarid regions and planted to some extent for forage in the extreme southern part of the United States. It grows from 6 to 10 ft. high bearing very numerous leaves, about ½ in. wide, and a conspicuous flowering panicle, about a foot long, composed of many brownish spikelets.

SUDANO-GUINEAN LANGUAGES, a group of African languages spoken south of the Sahara, west of the HAMITO-SEMITIC group, and north of 6° N. lat., although the Nilotic languages and those of Somaliland are not invariably classified here. The whole linguistic family is divided into some 16 subgroups with over 435 languages; and these are of various types, Mande, for instance, having no gender, HAUSA masculine and feminine, and Peul (or Fula) no less than 17 non-sexual genders. In many of them, the monosyllabic words have special tones which play an important part in those languages (Ewe, Yoruba, etc.) whose simple words are all monosyllabic. The

theory of the origin of the entire group from ancient EGYPTIAN explains the traits which the Sudano-Guinean languages possess in common, and, since their geographical diffusion has been gradual, it also accounts for the differences which render classification difficult.

L. H.

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SUDBURY, a city and the county seat of the Sudbury District, an outport of northern Ontario, Canada, situated about 300 mi. northwest of Toronto, in a picturesque, wild and rocky countryside. The surrounding region produces 90% of the world's nickel supply, and also yields nearly all of Ontario's copper production as well as some gold, lead and zinc. The chief industry of Sudbury and the neighboring towns is smelting. It is the seat of the Government School of Mines and a Jesuit college, and has various churches and two parks. Sudbury was founded by the Canadian Pacific Railway and incorporated in 1893. Pop. 1921, 8,621; 1931, 18,370.

SUDDEN SAWLOG, the name given, especially in the northern parts of the Great Plains region, to a variety of **POPLAR** grown for soft timber and quick shade. It is regarded as a form of the cottonwood (*Populus balsamifera*) or a hybrid from it, probably of Siberian origin. The tree is remarkable for its great hardness and rapid, vigorous growth, attaining a height of 50 or 60 ft. and a trunk diameter of 8 in. within seven years after planting by cuttings. In the United States the tree first claimed the attention of foresters in 1904 in Scandinavian settlements in Minnesota. It is now experimentally grown as a possible source of pulp wood.

SUDERMANN, HERMANN (1857-1928), German poet, dramatist and novelist, was born at Matziken, East Prussia, Sept. 30, 1857. He studied at Königsberg and Berlin and acted as tutor and later as editor of a small newspaper. He first achieved fame through his realistic drama *Die Ehre*, produced in 1888. This was followed in 1892 by *Heimat*, or *Home*, also known as *Magda*. Both dramas dealt with the conflict between the ideals of the old and the new generation. These eloquent attacks on conventional morality achieved international fame, and it was immediately conceded that a new and outstanding dramatist had arisen. Meanwhile *Frau Sorge*, 1888, a powerful novel with a somber social background, brought Sudermann additional celebrity, accentuated by the popularity of two additional novels, *Der Katzensteg*, or *The Cat Bridge*, 1890, and *Es War*, or *It Was*, 1894. Sudermann has been much criticized because of the uneven quality of his work. His sense of stage effects and dramatic values was unerring, and this power occasionally induced him to court popularity rather than to trust to artistry. The combination of true artistry and pandering to popular taste is best exemplified in many of his later works. Some of his best work is found in the three one-act

plays entitled *Morituri*, 1896, in which death exposes all sham and shallow striving; this is generally considered his maturest production. Other works to be noted are *Johannisfeuer*, or *The Fires of St. John*, 1900, highly praised for its poetical charm and eloquent passion, and the *Song of Songs*, 1909, a strikingly successful novel in which the Ideal is defeated and the soul sinks to unworthy levels. Among his last novels were *The Mad Professor*, 1926, and the *Wife of Stephen Trumholdt*, 1927. Sudermann died in Berlin, Nov. 21, 1928.

SUDHOFF, KARL (1853-), medical writer, of Frankfort on the Main, practiced medicine many years before being appointed to the directorship of the Institute für Geschichte der Medizin at Leipzig in 1905. He has written extensively on medical historical subjects and has made many of the rare medical texts available to German readers through his *Klassiker der Medizin*. Sudhoff's reading has given him an insight into medieval medicine which is said to be possessed by no other man, and his conversation is an inspiration to his pupils.

M. F.

SUE, EUGÈNE (Joseph Marie) (1804-57), French novelist, whose real name was Marie Joseph Sue, was born in Paris, Jan. 20, 1804. His father was a distinguished army surgeon, and the son followed in his footsteps until the inheritance of a fortune in 1829 offered leisure for the pursuit of literature. He won lasting fame with the two novels of his mid-career, *Les Mystères de Paris*, 1842-43, and *Le Juif Errant*, 1844-45; these have been translated into other languages, and also dramatized. His other works include *Lautréaumont*, 1837, and *Les Sept péchés capitaux*, 1847-49. Sue was a member of the Assembly after the Revolution of 1848, but was exiled in 1851 as a result of his opposition to Louis Napoleon. He died at Annecy, Savoy, Aug. 3, 1857.

SUETONIUS (GAIUS SUETONIUS TRANQUILLUS), Roman historian living at the end of the first and the beginning of the second century of our era. As the secretary *magister epistularum* of the emperor Hadrian he had an excellent opportunity to acquaint himself with official documents. These, together with the gossip of society, afforded him ample material for his *Lives of the Caesars*, a series of biographies of the first 12 emperors. Of his *De Viris Illustribus* the lives of Terence and Horace are alone preserved entirely. Lacking critical discrimination Suetonius freely indulges his taste for scandalous gossip.

SUEVI, a name applied indiscriminately to several Germanic tribes. Caesar mentions them as a warlike group subsisting mainly on plunder and their own flocks. As early as 70 B.C. they raided eastern Gaul under their king Ariovistus. In 406 Suevi joined the **VANDALS** in making their way across Gaul and ultimately into Spain. Here they founded an ephemeral kingdom in northwestern Spain, which was soon absorbed by the Vandals. During the 5th century other Suevi occupied the upper Rhine in the region of the Black Forest, where they remained to become the ancestors of the medieval Swabians.

SUEZ, a city of Egypt, situated at the Red Sea terminus of the Suez Canal, about 75 mi. east of Cairo. Previously a desolate spot, Suez is now a flourishing city with many fine buildings, an oil refinery and connections with the railroad system of Egypt through the junction of Ismailia. It is largely built upon "made" land, and in part of the Terre Pleine quarter the houses are on causeways forming four sides of a square, with a pond of sea-water in the center. Standing on the frontier of the Near East, Suez is distinctly non-Egyptian and bears great resemblance to the Far East. Pop. 1927, 40,523.

SUEZ CANAL, an artificial waterway severing the narrow Isthmus of Suez, which connects the continents of Asia and Africa, and linking together the Mediterranean and Red Seas. The idea of a canal across the Isthmus of Suez, an ancient one, first attained practical form about the middle of the 19th century. Influenced by the St. Simonists who advocated the construction of inter-oceanic canals as a part of their program for regenerating the world, FERDINAND DE LESSEPS succeeded in obtaining from the Khedive of Egypt, in 1854, a concession authorizing the creation of the *Compagnie universelle du canal maritime de Suez*. In 1856 this concession was reaffirmed and amplified. Inasmuch as Egypt was nominally a part of the Ottoman Empire, however, the assent of the Porte was necessary to the undertaking. The British government, fearing injury to British maritime interests and the increase of French influence in the Orient, exerted its powerful influence at Constantinople against the project, and not until the year 1866 did the Sultan give his formal approval.

De Lesseps, nevertheless, proceeded with his plans. In 1858 the capital stock of the Suez Company, 200,000,000 francs, was offered to the public in 500 franc shares. Within a month's time more than three-fourths of the whole had been taken up, mostly by French and Turkish investors. The Khedive took the remainder. In April of the following year the actual work of construction was commenced. Progress was slow. Differences between the Egyptian government and the company, which threatened for a time to put an end to the work, were referred to Emperor Napoleon III for arbitration. Among other things the system of forced labor, provided for by the Concession of 1856, was discontinued. This proved highly beneficial, for it led to the introduction of mechanical devices and improved engineering methods. The total cost of construction, 432,807,882 francs, was considerably more than twice the original estimate. The company, therefore, found its financial resources inadequate to complete the work and at times was forced to resort to extraordinary measures in order to finish it.

Despite these numerous obstacles the canal was completed in 1869 and formally inaugurated by a brilliant celebration at Port Said, Nov. 16, graced by the presence of the Empress Eugénie. Financial returns from the canal during the first two years were

disappointing, failing to cover the expenses of operation. The company was saved from bankruptcy only by the marked increase in revenue that rapidly set in after 1871. In 1875, Disraeli, British prime minister, hearing that the spendthrift Khedive of Egypt was seeking a purchaser for his shares in the Suez Co., and fully appreciating the political importance of the canal to the British Empire, secretly negotiated the purchase of the Khedive's 176,602 shares for £3,976,582, thereby precluding the possibility of their falling into the hands of a rival or hostile power.

The Suez Convention, 1888, signed by the principal interested powers, elaborated upon the provisions set forth in the concessions of 1854 and 1856 by declaring that the canal should "always be free and open in time of war as in time of peace to every vessel of commerce or of war, without distinction of flag." During the World War the canal was carefully guarded by a British army and the British and French navies. Once in Feb. 1915, it was menaced for a short period by the Turks.

To-day the British government owns seven-sixteenths of the total shares of the company. Although the French government owns no shares, 21 of the 32 members of the Board of Management are Frenchmen, and the company has retained its French character. According to the original concessions, the concession is to run for 99 years after the date of the opening of the canal, at the end of which period it will revert to the Egyptian government.

In 1870 the traffic of the Suez canal amounted to 654,915 tons; in 1930 the total traffic was 33,466,014 tons.

SUFFOLK, a city in Nansemond Co., southeastern Virginia, situated on the Nansemond River, 20 mi. southwest of Norfolk. It is served by six railroads and a waterway to the Atlantic Ocean. The region is agricultural. Suffolk has oyster and meat packing plants and large peanut products factories, woodworking and textile mills. The retail trade in 1929 amounted to \$6,239,356. Pop. 1920, 9,123; 1930, 10,271.

SUFFRAGAN, in the past a term sometimes used in the Catholic Church to designate an auxiliary bishop. At present, however, it refers to the Bishop of a diocese in relation to his archbishop. Though the suffragan yields precedence to the archbishop when he visits his diocese, he is independent of the archi-episcopal jurisdiction to a very great extent. In the Anglican Church a suffragan bishop is assistant to a diocesan bishop.

SUFFRAGE. Both in Europe and in America the right to vote was narrowly restricted until the beginning of the 19th century. In the American colonies at the time of the Revolution, it is estimated that not more than one-fifth of the adult male population possessed the franchise. The movement for the democratization of the suffrage in America had its roots in four sources. Certain abstract ideas relative to the suffrage played a part, but much more important were the influence of the frontier, the rise of a proletarian

class and the development of a *nouveau riche* class with fortunes in forms of property other than land. In consequence of these social forces, restrictions upon suffrage in America were for the most part swept away by 1829, and universal white male suffrage conceded. In 1870, as a result of the Civil War, the franchise was extended to include all male citizens irrespective of color. Still another half century later, the final restriction was removed; the battle for WOMEN'S SUFFRAGE was won and universal suffrage had arrived. S. C. W.

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SUFU, SUFISM, terms which apply to the mystic system of *tasawwuf* and its adherents. The common root is the Arabic *suf*, meaning wool, and the strict meaning of Sufism is "the wearing of the woolen robe" in token of devotion to the mystic life. Soon after the term *al-sufi* came into use in Iraq, about the 9th century, in connection with ascetic practice, it came to be applied throughout a widening area of the Moslem world to all mystics, and Sufism became a recognized movement. Moslem mysticism may rightly be traced from the Prophet himself, but it established itself within Islam with difficulty. The Sufis came into conflict with administrative authorities, at times, and always were questioned by the traditionalists. The great doctor al-Ghazali (c. 1100) sealed the inclusion of mysticism within Islamic orthodoxy. Sufis have aimed, generally, at fervent worship to engender inner realities, and the acquisition of divine wisdom bringing union with God. God only exists; beings are emanations from him; religions as such are matters of indifference; God's grace saves; life is a journey; the seeker is a traveler, and the end is God. J. C. A.

SUGAR, a sweet colorless crystalline substance derived from the juices of various plants and manufactured for use as an article of food. Commercial production is principally from sugar cane and sugar beets.

PROCESSES OF PRODUCTION

Manufacture of Beet Sugar. Beets, after they have been received at the factory, are cleaned and shredded into shoestrings called cossetts. These are charged into a diffusion battery which consists of from 10 to 18 vessels, so arranged that heated water can be introduced in any of the cells in the battery, and the sugar-containing juice withdrawn from any of the cells; and so connected that the juice from any one cell can be introduced to the next cell, with or without the addition of heat. Water is introduced into the last cell and pressed forward over the partially exhausted cossetts, emerging from the newest cell as diffusion juice. This juice is limed and gased with carbon dioxide (CO₂) which precipitates the lime and other organic impurities. It is then filtered over cloth and the carbonation continued in one or more extra steps with or without the addition of soda ash and sulphurous acid until the maximum clarification has been accomplished and a minimum amount of

lime left in the liquor. It is then concentrated to a thick liquor and subjected to a further lime removal and impurity removal step, generally with the addition of sulphurous acid, with or without the assistance of a small amount of carbon. The decolorized purified thick liquor is crystallized in vacuum pans similar to those used in cane sugar refining. The after sugars are not sold as such but are remelted and introduced into the high purity liquors from which the white sugar is produced. The final molasses is usually sold to the fermentation and feed industries, but where price and freight make this policy economically unsound the molasses is given a desugarizing process in which the oxide of one of the earth metal alkalis such as *lime*, *barium* or *strontium* are used to form saccharates. The saccharates formed are removed by filtration from the molasses impurities. The washed saccharates have the sugar liberated and the metal oxide removed either in a separate channel of their own or, in the case of the lime saccharates, by introduction to the main clarification process which serves the dual purpose of adding the lime required for clarification and liberating the sugar by the introduction of the CO₂ gas used in this step.

BEET SUGAR PRODUCTION, U.S.

Year	No. Establishments	Wage Earners	Wages	Value of Products
1899..	30	1,970	\$ 1,092,207	\$ 7,323,857
1904..	51	3,903	2,486,702	24,393,794
1909..	58	7,204	4,808,446	48,122,383
1914..	60	7,997	6,606,204	62,605,210
1919..	85	11,781	15,908,118	149,155,892
1921..	92	13,602	22,658,392	139,109,655
1923..	84	7,571	10,103,182	118,313,978
1925..	89	8,872	12,088,057	132,339,012
1927..	79	7,402	9,709,969	104,926,584
1929..	82	7,496	10,020,743	108,552,581

Manufacture of Cane Sugar. The sugar cane is stripped of its leaves and head and is then placed in a disintegrating device called a shredder, from which it passes to very heavily grooved rolls called a crusher. Here, the major portion of the juice is extracted and large pieces of cane, which have passed the disintegrator intact are partially disintegrated. The residual juice is removed by passing through a multiple series of rolls arranged in tandems, each unit of the series consisting of three rolls, the top roll of which rides in contact and under pressure with each of the two bottom rolls. The extraction is assisted by the addition of water to the cane between rolls. On most plantations, the extracted cane, called bagasse, is used as fuel under the boilers. At other places close to transportation it is baled and sent to manufacturers who produce from it wall boards and insulating materials.

In removing impurities from the extracted juice there are several procedures the use of which is governed by market conditions and transportation cost. The simpler procedure most commonly used is the following: *Lime* is added to the extracted juice so

that the impurities are precipitated. The juice is brought to a boil and allowed to clarify either in batches or continuously. The clear juice is decanted and concentrated. The thick juice is introduced into vacuum pans, taking into the pan initially about one fifth as much liquor as will be required to finish the batch. This initial charge is concentrated until crystallizing starts; when this has proceeded far enough, depending upon the liquor and the size and character of the sugar desired, fresh thick liquor is again introduced in amounts sufficient to keep the already formed crystals growing and to prevent other crystals from forming by too great a concentration. When the crystals have become sufficiently large and the mass sufficiently concentrated into solid sugar, it is discharged from the pan. The discharged material is delivered to centrifugal machines having a perforated basket which is lined with a metal screen, the holes of which are sufficiently small to retain all the sugar and sufficiently large to permit the free exit of the mother liquor. In the better products, the centrifugal sugar is washed; in others, it is discharged without washing. These sugars are called centrifugal raws, the sugar content and moisture content of which is regulated by tariff and transportation conditions. The raw sugar is then sent to the refinery which is usually close to the point of consumption.

At the refinery, the raw sugar is mixed with sufficient water or syrup to make a semi-fluid mass resembling wet sand. This is fed into a battery of "washing" centrifugals similar to that described above. The wash water or syrup leaving the machines is clarified, filtered, carbon treated and mixed with liquors from the melt of about the same purity or sugar content. The sugar in the centrifugals is discharged to a tank containing hot water in which it is melted to about a 55% solution. The melted sugar is clarified, filtered over cloth and sent to the carbon treating system, boneblack being generally used for this purpose. The carbon treatment removes colloidal material, color and a certain amount of ash. The water white liquor is sent to crystallizing pans and boiled to grain similar to that described under raw cane, the centrifugals in this instance, however, being washed with the very finest water that the refineries know how to produce. The washed sugar is sometimes packed in barrels as such, but is generally dried in rotating hot air dryers, screened to the various sized demanded by the trade, and packed.

The mother liquor from this sugar is again boiled and another crop of sugar crystals removed. This is continued until the color, turbidity, or purity require an additional refining, at which time the sugar is clarified if necessary, filtered and carbon treated. Sugar is again removed from the lower grade liquor. When the sugar removed can no longer be washed water white it is marketed as soft sugars which run in color from a slightly yellowish white to a rather dark brown. The soft sugars are graded according to their color and taste. If there is no market for

these soft sugars they are melted, refined and introduced to the main flow of liquors according to their purity. When the purity of the main channel has been reduced to the purity of the washed liquors of the first step, the two are combined, clarified and carbon treated and received through a continuation of the main channel. The final molasses may be carbon treated and sold for table purposes or for blending purposes without treatment, or may be used in the feeding stuffs and fermentation industries. See also CARBOHYDRATES.

W. B. N.

CANE SUGAR REFINING, U.S., 1909-29

Year	No. Establishments	Wage Earners	Wages	Value of Products
1909..	19	9,399	\$ 5,620,971	\$248,628,659
1914..	18	11,253	7,823,377	289,398,715
1919..	20	18,202	22,710,464	730,986,706
1921..	20	15,457	19,463,410	466,602,352
1923..	20	15,254	20,044,499	726,241,577
1925..	21	14,502	18,955,114	606,632,783
1927..	21	13,996	17,707,257	597,445,632
1929..	21	13,912	17,850,493	507,389,262

CANE SUGAR PRODUCTION, U.S., 1909-29

Year	No. Establishments	Wage Earners	Wages	Value of Products
1909..	214	4,127	\$1,862,751	\$30,620,738
1914..	181	3,632	1,561,376	21,635,373
1919..	202	6,101	4,009,369	57,741,320
1921..	134	2,724	2,296,207	22,961,221
1923..	122	2,820	1,727,893	27,180,783
1925..	94	2,066	1,410,964	13,434,999
1927..	53	971	639,154	8,009,120
1929..	70	2,319	1,642,463	18,325,792

Dextrose (Starch or Corn Sugar). This is produced principally from corn starch by conversion with acid (and heat). Conversion liquor is neutralized, and decolorized with bone char before evaporating in vacuum pan. The syrup is transferred to crystallizers where crystallization occurs. The products are refined corn sugar (hydrate or anhydrous) and sugars of lower grades designated as 70-degree and 80-degree sugar.

By-Products: The by-products resulting from the manufacture of sugar are:

From Raw Cane Sugar Manufacture: Cane residue or "bagasse," used primarily for fuel in Louisiana and also for manufacture of fiber board such as "Celotex"; filter press cakes as fertilizer; and blackstrap molasses in fermentation industries and in molasses stock feeds.

From Beet Sugar Manufacture: Beet residue or pulp used as stock food; filter press cakes and waste waters, discarded; and discard molasses used for molasses stock feeds and for production of yeast.

From Sugar Refining: Refinery blackstrap used for the same purposes as cane blackstrap. R. T. B.

BIBLIOGRAPHY.—C. F. Bardof and J. Q. B. Ball, *The Elements of Sugar Refining*, 1925; H. Classen, *Beet Sugar Manufacture*, 1919; N. Deerr, *Cane Sugar*, 1921; P. Geerlings, *Cane Sugar and Its Manufacture*, 1924.

CHEMISTRY OF SUGAR

Sugars constitute an important series of organic chemical compounds, composed of carbon, hydrogen and oxygen, belonging to the carbohydrate group. The usual classification of sugars is as follows:

I. **Monosaccharides.** Bioses, trioses, tetroses, pentoses and hexoses, containing 2, 3, 4, 5 and 6 carbon atoms respectively.

II. **Disaccharides.** Condensation products of two monosaccharides.

III. **Tri- and tetrasaccharides.** Condensation products of 3 and 4 monosaccharides respectively.

Many of the sugars are found free in nature, but their widest distribution is in combined form. These compounds, which include plant constituents such as gums, pentosans, glucosides, starch, inulin, cellulose, etc., are generally amorphous and are further characterized by yielding monosaccharides upon hydrolysis by acids or appropriate enzymes. Certain rare sugars are synthetic products of the laboratory and are not found in nature.

The most important sugars found free in nature are the hexoses ($C_6H_{12}O_6$), dextrose (d-glucose, corn, starch or grape sugar), and levulose (d-fructose or fruit sugar); the disaccharides ($C_{12}H_{22}O_{11}$), sucrose (cane, beet, maple, or palm sugar), maltose (malt sugar) and lactose (milk sugar); and the trisaccharide ($C_{18}H_{32}O_{16}$), raffinose. The principal sources of these sugars are given in the following table.

SUGAR	SWEETENING POWER * SUCROSE=100	SOURCES
Dextrose	53-74	Starch, dextrin, glucosides, sucrose, honey, fruits.
Levulose	103-173	Inulin, fruits, honey, sucrose.
Invert sugar (Dextrose: levulose = 1 : 1)	79-127	Fruits, honey, sucrose
Sucrose	100	Sugar beet, sugar cane, maple, palm, fruits.
Maltose	60	Starch, dextrin.
Lactose	27-28	Milk
Raffinose	slight	Sugar beet products, cotton seed meal.

* Results given are the maximum and minimum values found in various publications.

Many of the sugars function as polyhydroxyaldehydes or ketones which accounts for their reducing power. The structure of the sugar molecule is cyclic, one or more of the carbon atoms being assymmetric. In the sugar molecule, it is possible, therefore, to have many isomers; for instance, there are 16 aldohexoses arranged in 8 pairs, with one of each pair belonging to the dextrorotary (d-) series and the

other to the levorotary (l-) series. Also many of the sugars, for example, d-glucose, can be isolated in two distinct forms termed α and β sugars, which have distinct properties and upon solution in water produce an equilibrium mixture. The change in polarization or specific rotation during production of equilibrium is known as "mutarotation." This property is exhibited by all reducing sugars. Mutarotation is catalyzed by acids or preferably dilute alkalis, and advantage is taken of this fact in analytical work.

Identification of pure sugars is usually made by a determination of the specific rotation, of the melting point of some of their characteristic crystalline compounds, such as the osazones, or of their reducing power. Quantitative methods of sugar analysis are usually based upon single or double (before and after hydrolysis by acid or enzyme) polarimetric measurements, upon reducing action of the sugar on alkaline copper solutions or upon fermentation tests. See also CARBOHYDRATES.

R. T. B.

BIBLIOGRAPHY.—E. F. Armstrong, *The Carbohydrates and the Glucosides*, 1924; C. A. Browne, *Hand Book of Sugar Analysis*, 1912; W. N. Haworth, *The Constitution of Sugars*, 1929.

SUGAR BEET, a biennial plant of the goosefoot family, grown as a source of sugar and for stock food. It is usually considered to have been developed from the garden beet (*Beta vulgaris*) but not all botanists hold this opinion. Though the roots resemble in form those of the half-long or intermediate varieties of garden beet they are white or yellowish and larger, but not so large as those of the mangel wurzel. Sugar beets are still further distinguished by their content of sugar which during the past century, by breeding and selection, has been steadily increased from less than 7% to more than 14.5% as an acre average, with individual roots analyzing as high as 20%. Such individuals are chosen for breeding in order to maintain the high average sugar content. The modern sugar beet is therefore one of the most marvelous examples of development among plants, especially when it is noted that the tonnage-to-the-acre yields have been increased, though the weight of roots necessary to produce a pound of sugar has been lessened from 18 lbs. a century ago to less than half that quantity today. Not only have the beets themselves but also the methods of culture been so improved that though land is high priced in Europe and labor is costly in America the crop is profitable in both continents.

As beet sugar factories are expensive to erect and operate, suitable soil of sufficient extent is first located by exhaustive experiments. The beets thrive best in cool climates and in well drained, deep, rich loams. These are found in central Europe and northern and western United States and adjacent Canada. Specialists teach the growers how to prepare the land, sow and cultivate the crop, combat insect and disease enemies, harvest and handle the mature roots and so on. Much of the work is done by machines, but considerable hand work is also involved; so it is essen-

SUGAR

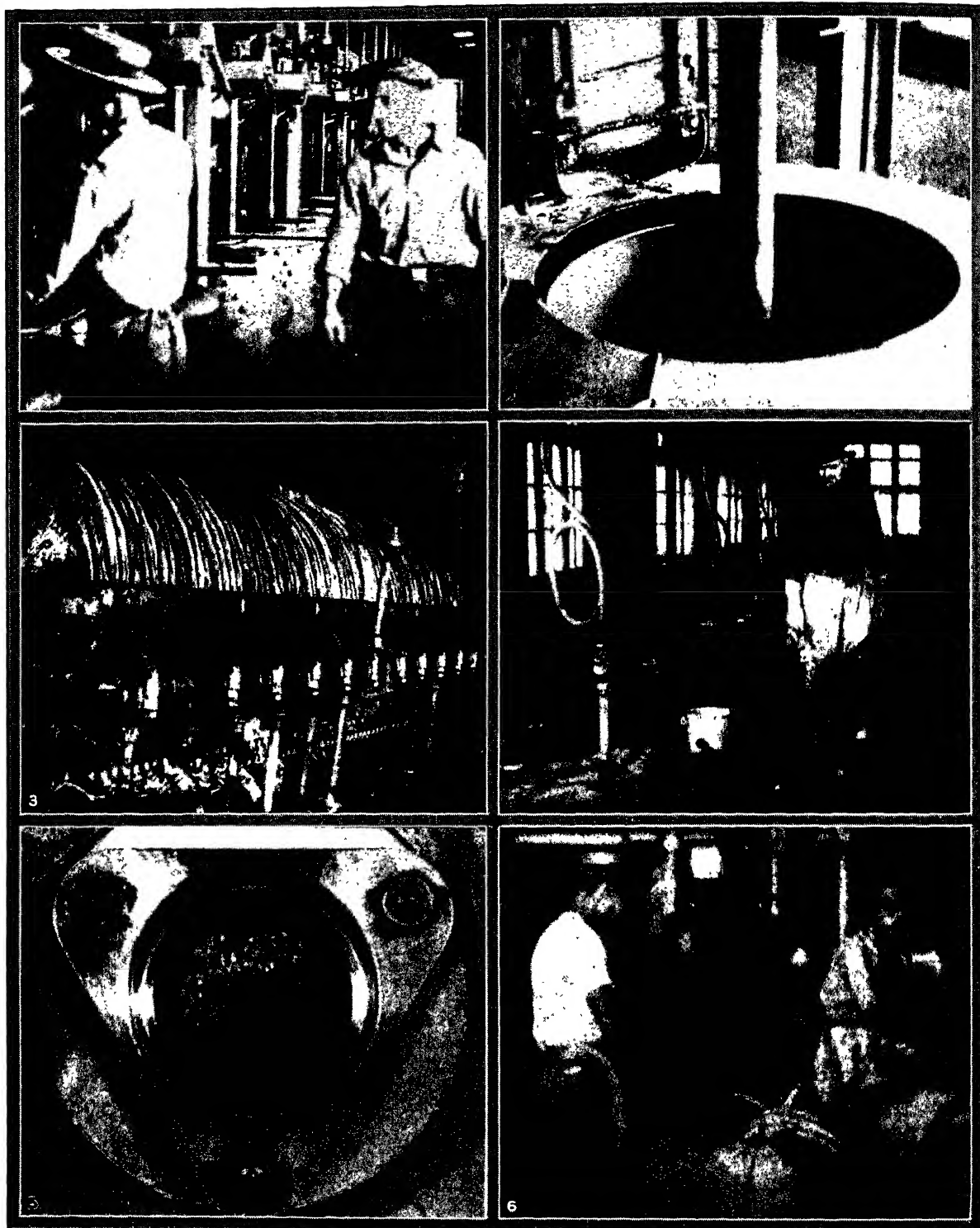


1, 2, 3, COURTESY FILMS OF COMMERCE, INC.; 4, LOUISIANA CHAMBER OF COMMERCE

I. RAW SUGAR PRODUCTION

1. Laborers planting the sugar cane seed.
2. The vacuum pans in which the syrup from the cane is boiled to effect crystallization.
3. Open pan in which the juices are evaporated to produce a syrup.
4. Laborers cutting sugar cane.

SUGAR



COURTESY FILMS OF COMMERCE, INC.

II. SUGAR MANUFACTURING PROCESSES

1. Evaporators which separate sugar crystals from the syrup.
 2. Centrifugal in which the raw sugar is washed to remove the molasses covering. 3. Filter press for purifying the sugar solution. 4. Adding bone charcoal to remove the col-

loidal material, color, and some ash. 5. The crystallization of the sugar as observed through the indicating "window."
 6. Sugar packed into bags, after the final stages of purification and crystallization.

SUGAR BEET PRODUCTION, U.S.
5-Year Average, 1926-30

<i>Division</i>	<i>Acreage</i>	<i>Production (Tons)</i>	<i>% of Tot. Prod.</i>
UNITED STATES	706,000	7,714,000	100.0
LEADING STATES:			
Colorado	212,000	2,798,000	36.3
Nebraska	84,000	1,033,000	13.4
Utah	50,000	570,000	7.4
Michigan	81,000	560,000	7.3
California	53,000	559,000	7.3

tial that the fields be located near adequate supplies of labor. Average yields are about 12 tons of beets and 2 tons of sugar to the acre, though these are often exceeded 10 to 20%. M. G. K.

SUGAR CANE (*Saccharum officinarum*), a stout coarse perennial of the grass family, one of the world's most important economic plants, yielding cane sugar. It is believed to be native in farther Asia or the East Indies but is probably a cultigen as the parent wild species has not been discovered. The Greeks and Romans at the time of Strabo, Dioscorides and Pliny had a somewhat vague knowledge of the reed from which the people of India obtained SUGAR. In the Middle Ages the Arabs introduced sugar cane into Egypt, Sicily and Spain where its culture flourished until the development of sugar production in the American colonies. Sugar cane was taken to Brazil about 1500, to Mexico soon thereafter, and is now cultivated in most warm regions, especially in the East and West Indies, Hawaii and Brazil. The plant produces solid, jointed, maize-like canes bearing long stiff leaves and a large terminal flowering panicle. It does not bloom in the United States and, though flowering freely in the tropics, very rarely produces seeds. For commercial production sugar cane is propagated entirely by pieces (cuttings) of the stem. See also GRASSES; SORGHUM.

SUGAR OF LEAD, a colorless, transparent, crystalline substance having a sweetish taste; chemically, lead acetate, $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$. The crystals are soluble in water; on exposure to the air they become opaque. Lead acetate may be prepared by heating lead oxide with acetic acid. It is used in the arts, and in refining sugar. In medicine, it serves as an astringent.

SUGGESTION, the acceptance of a proposition without logical grounds; a proposition to action which overcomes antagonistic impulses. The first definition is from McDougall, the second from Hugo MÜNSTERBERG. In either case suggestion is a social phenomenon. The subject gets his cue from another, and when other ideas have been sufficiently inhibited, the suggestion is acted upon.

Allport has ably pointed out three functions of suggestion; the formation of attitudes, the release of a response and the enhancing of a response already released. When a man is in a crowd he is apt to do as the crowd does. He is more suggestible because he is off his guard, so to speak. His personality is

comparatively disorganized and he becomes a prey to the suggestions of the crowd. His attitude is thus determined by suggestion. Suppose, on the other hand, that a favorable attitude towards a certain course of action has already been built up. Here suggestion simply serves as a release; it is the stimulus that calls forth a response that in some measure was waiting for it. Suggestion may serve also to increase a response that is already under way. Action has started and suggestion merely furthers rather than inhibits it.

SUICIDE, the taking of one's own life. Although the United States and most of the European countries for which statistics are available show that suicide rates decreased during the World War, the general trend before and since the war is upward. Norway and Denmark are exceptions, having had decreasing rates for many years. The most recent figures available for the United States give a rate of 13.6 suicides per 100,000 people in the registration area for 1928.

The suicides in Europe and America are almost all caused by personal crises—deaths of loved ones, economic failures, disgrace, illness, insanity and other crises which destroy the routine of living or thwart some keen desire. Formerly Asia had another form of suicide—ceremonial suicides such as *hara-kiri* in Japan or *suttee* in India. Similar types were also found in parts of Europe before the doctrines of Christianity established the belief that the individual's life is sacred and that it is sinful to commit suicide. Accounts of primitive people indicate that few of them commit suicide, although a few groups have ceremonial suicides.

In Europe and America three or four times as many men as women commit suicide. Few children commit suicide. In the United States in 1928 there were no suicides under ten years of age and of all suicides only .26% were between 10 and 14 years of age and 2.89% between 15 and 19 years of age. Suicide rates increase steadily with age. In Europe (figures not available for the United States) the suicide rate is higher among the educated classes than among the uneducated; and it is higher among Protestants than among the more closely organized Catholics and Jews. In both Europe and America cities have much higher rates than do adjacent small towns or rural areas. It is not possible to establish a clear relationship between climate and suicide or between race and suicide.

Suicide, or self-killing, is generally considered a felony by the common law in England and by statute in the United States. At one time in England the suicide's property was forfeited to the crown but this law has been abrogated. In some states of the United States an attempt to commit suicide is considered a crime. See CRIMINAL LAW. R. S. C.

BIBLIOGRAPHY.—A. D. Frenay, *The Suicide Problem in the United States*, 1927; Ruth S. Cavan, *Suicide*, 1928.

SUITE, a collection of instrumental compositions or movements, most of which may be traced directly to old-time dances. Such a cycle of contrasted move-

ments was very popular throughout Europe in the 17th and 18th centuries, and indeed took the place of the SONATA and SYMPHONY which it foreshadowed. To-day the suite is still composed, but its popularity has definitely waned. In the modern form may be encountered contrast in keys, but in the olden form of the classical period it was the custom to compose all the various movements in one key. The number of these movements varied greatly, according to the desire of the composer. What might be considered the standard arrangement, however, was the following order: 1. ALLEMANDE, 2. COURANTE, 3. SARABAND, and 4. GIGUE. In addition to these there were interpolated movements, the chief of which were the GAVOTTE, BOURRÉE, passepied, PASSACAGLIA, musette, and MINUET. As showing the looseness of this form, it is interesting to compare Handel's eleventh suite in B flat major, which contented itself with the four standard movements aforementioned, and J. S. Bach's sixth English suite in D minor (which boasts a prelude, allemande, courante, saraband, double or variation, gavotte, musette, and gigue).

As the precursor of the SONATA and SYMPHONY, the suite has great historical importance; it serves also as an important link between the dance and the art of instrumental music in that it took over the mere forms which accompanied dancing and elevated these to a position of musical independence.

SULEIMAN or **SOLYMAN** or **SOLIMAN I**, or **II** according to some European historians (1494-1566), called the Magnificent, the Great, the Law-Giver.

The reign of the sultan Suleiman I (1520-66) marks the high point of the power of the Ottoman empire. Succeeding his father Selim I, Suleiman came to the throne of a prosperous and united country. At first he set himself to right some of the injustices of the previous reign, to improve the administration and to reform part of the legal system. Soon, however, he set out on the career of conquest which was to make him feared all over Europe. Time after time he invaded Hungary and the eastern dominions of the Holy Roman Empire (1521, 1526, 1529, 1530, 1541, etc.). In 1526 he crushed the power of the Hungarians in the great Battle of Mohacs, but he was thwarted three years later in his attempt to capture Vienna. Nonetheless he added Moldavia and other larger territories to his dominions, and throughout his reign he was a constant threat to Christian Europe.

In a series of wars (1533, 1548, 1553) Suleiman humbled the Persian monarchy. His Mediterranean conquests (Rhodes, Aden, Tripoli, Algiers), his defeat of the combined forces of the Spanish and the Knights of Malta (1561), his treaty of commerce with Francis I of France (1535), all tended to raise the prestige of the Ottoman Empire and make it one of the strongest powers in Europe.

The latter part of Suleiman's reign was marked by harem intrigues and plots. His favorite, Roxelane, wishing to have one of her sons succeed to the throne, accused Mustapha, Suleiman's son by another wife,

of plotting treason with the king of Persia. As a result the young prince was strangled by his father's orders (1553). From this time on the influence of the harem became more and more marked in Turkish history. Suleiman died in 1566, during a siege of a town in Hungary.

SULLA, LUCIUS CORNELIUS (138-78 B.C.), Roman general, statesman and dictator. As quaestor 107 B.C. under MARIUS in the Jugurthine War he won the distinction of capturing Jugurtha. A few years later he rendered good service when Rome was threatened by the Cimbri and Teutones, 104-101 B.C. In the SOCIAL WAR, 90-88 B.C., Sulla outshone Marius and in 88 B.C. he was elected consul and appointed by the Senate to the command of the Mithridatic War. Marius on Sulla's departure from Rome brought about a reversal in Sulla's appointment, securing it for himself. Sulla promptly returned with his army, defeated Marius, and forced him to flee. Sulla then proceeded to Greece where after a long siege he took Athens, which supported the cause of Mithridates, 86 B.C. After victories over Archelaus, the general of Mithridates, in Greece, Sulla crossed the Hellespont and concluded a peace with the Mithridates, 84 B.C. Meanwhile the Marian party had occupied Rome and brutally butchered many of Sulla's supporters. Sulla returned to Italy, 83 B.C., and defeating his foes, became dictator in Rome, 82 B.C. After wreaking vengeance on his enemies by putting them to death and confiscating their property, Sulla devoted himself for three years to constructive statesmanship, his central purpose being to restore to the Senate its former powers and dignity, which it had lost in the last 50 years. Thus senators were now to sit on the juries to try provincial governors on charges of extortion, and disabilities were to be imposed upon the tribunes, the popular leaders. Sulla, moreover, created a number of permanent courts, each of them under the presidency of a praetor. In 79 B.C. the year before his death, Sulla retired into private life. A consummate general, Sulla was also an able politician and a constructive statesman. Unfortunately he was careless of the means used to effect his purposes.

SULLIVAN, SIR ARTHUR SEYMOUR, (1842-1900), English music composer, was born at London, May 13, 1842. He studied at the Royal Academy of Music, winning the Mendelssohn Scholarship, and continued his studies at the Leipzig Conservatory. Incidental music to *The Tempest* brought him his first public recognition, widened soon afterward by his oratorio, *The Prodigal Son*. He next essayed comic-opera with *Box and Cox* and *Contrabandista*, and in 1871 inaugurated the long and phenomenally successful series of comic-operas produced in collaboration with W. S. GILBERT (1836-1911), consisting of *Thespis*, 1871, *Trial by Jury*, 1875, *The Sorcerer*, 1877, *Pinafore*, 1878, *Pirates of Penzance*, 1880, *Patience*, 1881, *Iolanthe*, 1882, *The Mikado*, 1885, *Ruddigore*, 1887, *Yeomen of the Guard*, 1888, *The Gondoliers*, 1889, *Utopia Limited*, 1893, and *The Grand Duke*, 1896. During differences between him and Gilbert,

he availed himself of other librettists for *Haddon Hall*, 1892, *The Beauty Stone*, 1898, and *The Rose of Persia*, 1900. His other compositions include the opera *Ivanhoe*, his only grand opera, successful in England, the oratorio, *The Light of the World*, incidental music to several Shakespeare plays, a number of admirable hymns, among them *Onward*, *Christian Soldiers*, and a number of songs, notably *The Lost Chord*. The music of the operettas is gay and humorous, abounding in delightful changes in mood, and daintily orchestrated. In 1878 Sullivan was made a Chevalier of the Legion of Honor and in 1883 he was knighted. He died at London, Nov. 22, 1900, and was buried at St. Paul's Cathedral.

SULLIVAN, JOHN LAWRENCE (1858-1918), American pugilist, was born at Boston, Mass., in Oct. 1858. He became ring champion when he defeated Paddy Ryan in 1882. On July 8, 1889 Sullivan fought 75 rounds with Jake Kilrain at Richbourg, Miss., and won the American championship. But he lost this three years later at New Orleans, La., where he was beaten by Jim Corbett. Sullivan fought most of his bouts with bare fists, and was one of the most picturesque figures in the boxing world. He died in 1918.

SULLIVAN, LOUIS HENRY (HENRI) (1856-1924), American architect, was born in Boston, Mass., Sept. 3, 1856. He began the study of architecture at the Massachusetts Institute of Technology, but after a year he became dissatisfied with the type of instruction and left in 1873, going to Paris the next year to study at the Beaux-Arts. After his return he settled in Chicago, and in 1881 formed a partnership with Dankmar Adler, with whom he was to be associated for many years. In the firm Sullivan provided the dash and imagination, and Adler the competent, routine and business supervision, and the partnership became one of the most famous in the Middle West, building hundreds of banks, stores, and railway stations, the Transportation Building at the Columbian Exposition in Chicago in 1893 and the Auditorium Building in Chicago.

Sullivan felt all his life that the America of his generation had no place for him. He poured the bitterest scorn upon his fellow architects, accusing them of an easy eclecticism, of complete contempt for their materials, and of sacrifice of their art to financial profit. He demanded that in architecture the form of a building should follow the structural function, insisting that no building could be made beautiful merely by pasting a skin of ornamentation over a functionless whole. The influence of his teachings upon the succeeding generation of American architects was considerable, but by precept, not example, for Sullivan failed to build by his own standards.

His works all show somewhere the touch of Sullivan's genius, but their form rarely follows the function, for Sullivan arranged his massive blank walls, his uprights, his great, often too great, arches not in accordance with his own principles but to bring out the small surfaces of beautiful, highly intricate ornamentation. Herein Sullivan was a paradox: as a

teacher he is famous for his doctrines of function; as an architect he is famous for his beautiful ornamentation, an ornamentation which in his youth was strict and geometrical, in middle life increasingly intricate and sinuous, and in his last bitter, disappointed years becoming almost a dream world of mystical Oriental tracery.

Sullivan had great hopes of the steel skeleton construction, the skyscraper, and considered that he had pointed the way to successful solution of its problems in the Wainwright Building, St. Louis, Mo., but few architects admit his claim. Sullivan objected to the close congregation of skyscrapers, such as in downtown New York, on the ground that the function of the skyscraper was to soar, something it could not do when built in close packed masses. Sullivan died at Chicago, Apr. 14, 1924.

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SULLIVAN, a city in southwestern Indiana, the county seat of Sullivan Co., situated 26 mi. south of Terre Haute. It is served by three railroads. The region has coal fields and oil wells. Sullivan is a shipping market for these natural resources and for grain grown in the district. There are various manufactures, including brushes, flour, cheese, woolen goods and trucks. Shakamak State Park is northeast of the city. Sullivan was founded in 1842; incorporated in 1909. Pop. 1920, 4,489; 1930, 5,306.

SULLY, THOMAS (1783-1872), American painter, was born at Horncastle, Lincolnshire, England, June 8, 1783. He came to Charleston, S.C., with his parents in 1792, and first studied art under his brother, Lawrence Sully. For a short time he worked under Gilbert Stuart in Boston, and in 1809 was a pupil of Benjamin West in London. Sully settled permanently in Philadelphia in 1810 and became one of the most fashionable portrait painters of the day. In 1837 he revisited London in order to paint a full-length portrait of Queen Victoria for the St. George Society of Philadelphia. Sully was a rapid and versatile painter and had an unusual sense of decorative effect. There are over 3,000 listed portraits by him, besides miniatures and some 500 subject paintings. Among his well-known portraits are those of Lafayette in Independence Hall, Thomas Jefferson at the U. S. Military Academy at West Point, Fanny Kemble and John Marshall in the Corcoran Gallery, and Mrs. Reverdy Johnson in a private collection at Princeton. Sully died in Philadelphia, Nov. 5, 1872.

SULLY-PRUDHOMME, RENÉ FRANÇOIS ARMAND PRUDHOMME (1839-1907), French poet and philosopher, was born in Paris, Mar. 16, 1839. He received a scientific education but trouble with his eyes prevented its completion. Later he began to study law, but eventually devoted himself entirely to poetry. His first volume, published in 1865, was *Stances et Poèmes*. In 1888, on the pub-

lication of *Le Bonheur*, he abandoned poetry and turned his attention to philosophy and literary criticism; in 1892 he published *Réflexions sur l'art des vers*. In 1901 Sully-Prudhomme was awarded the Nobel Prize for literature, spending the money on establishing a prize for poetry. During the last years of his life he was paralyzed. He died at Châtenay, Sept. 6, 1907.

SULPHITE PAPER. See PAPER.

SULPHONIC ACIDS, in chemistry, are those compounds, organic or inorganic, formed by the union of the monovalent group SO_3H with other monovalent radicals. Inorganic and aliphatic organic compounds have only laboratory interest, but the aromatic sulfonic acids are of great importance in the manufacture of synthetic dyes (see DYES, SYNTHETIC), as e.g., anthraquinone sulphonic acid or alizarin. Commercially they are usually prepared by the action of concentrated SULPHURIC ACID with aromatic hydrocarbons such as BENZENE, NAPHTHALENE, or their quinones, the process being known as sulphonation. They generally appear in the form of deliquescent crystals or syrupy liquids, avidly soluble in water, and showing a very strong acid reaction. Treatment with caustic alkali results in the formation of phenols, such as ordinary phenol, or carbolic acid, and the naphthols from benzene, and of naphthalene monosulphonic acids and RESORCINOL from benzene disulphonic acid.

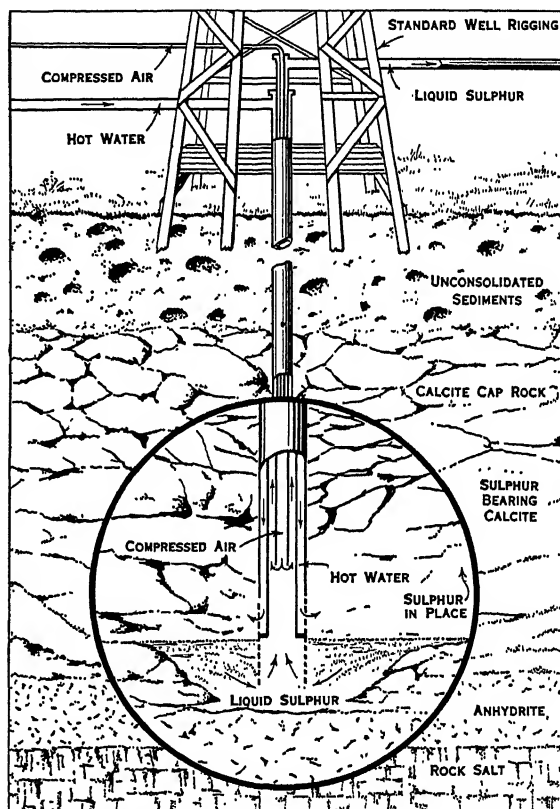
SULPHO-PHTHALIC ACIDS, the sulphonated organic compounds of phthalic acid, generally prepared by the action of fuming SULPHURIC ACID upon NAPHTHALENE. If the temperature is kept at 220°C . the monosulphonic acid is formed, but if the temperature be raised to 250°C . or higher, disulphonic acid results.

SULPHUR, a non-metallic chemical element (symbol S, atomic weight 32.06) which occurs abundantly in nature, in mineral form as well as in organic substances such as the PROTEINS. It is a constituent of all volcanic fumes, is found in the free state in extensive deposits near Girgenti in Sicily, and in Louisiana, and in binary combination with other elements in a large variety of sulphides, as with iron and copper in pyrites, with lead in galena, as well in the form of sulphates and other compounds. The Girgenti sulphur is often purified by melting in crucibles while that occurring in the subterranean beds in Louisiana is melted by circulating overheated steam through it, the liquid sulphur then being forced to the surface by compressed air, and yielding a product of a high degree of purity. Pure sulphur may appear in many different forms, crystalline as well as amorphous; the rhombic crystals are bright yellow in color, hard, and brittle, have a specific gravity of slightly less than 2, melt at 115°C . and boil at 445°C .

In air, sulphur burns easily with the characteristic blue flame of "brimstone," while being oxidized to sulphur dioxide, a gas, with the well known suffocating, pungent smell. Often sulphur dioxide is made directly by heating the various sulphides in a current

of air; upon being mixed with oxygen in the presence of a catalyst, such as platinum, it is converted into the trioxide, which, combining with water yields SULPHURIC ACID, by far the most important commercial sulphur compound.

Apart from the oxides, the most important sulphur compounds are the hydride, sulphuretted hydrogen or hydrogen sulphide (H_2S), the parent substance of all sulphides, and a poisonous gas with the nauseating smell of rotten eggs. It is actually a product of the putrefaction of proteins. Sulphur carbide or carbon bisulphide (CS_2), is a heavy, colorless, re-



COURTESY TEXAS GULF SULPHUR CO.

FRASCH PROCESS OF MINING SULPHUR

Steam is introduced into the sulphur deposit through a pipe. This melts the sulphur, which is forced to the surface through an interior pipe by means of compressed air

frangible liquid, which, if pure, has a pleasant smell, though actually it is nearly always contaminated with impurities which give it a disagreeable odor. Carbon bisulphide possesses anesthetic properties and is widely used as the only practicable solvent for RUBBER. If in sulphuric acid (H_2SO_4), one of the oxygen atoms is replaced by sulphur, thiosulphuric acid results, whose sodium salt ($\text{Na}_2\text{S}_2\text{O}_3$), commonly but incorrectly known as hyposulphite of sodium or "hypo," forms the universal fixing bath in photography.

In industry sulphur is used principally for the manufacture of sulphuric acid, for the vulcanization of rubber, for the tanning of leather, and the weather-

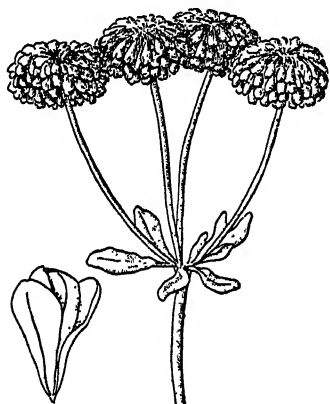
proofing and hardening of paper, fabrics, and even cement, in chemical warfare for making MUSTARD GAS.

W. J. L.

Medical Uses. Sulphur is official in the Pharmacopeia in three forms: *Washed Sulphur*, which is a fine yellow tasteless powder used locally in the treatment of parasitic diseases of the skin; *Precipitated Sulphur* (milk of sulphur), occurring as a fine, pale yellow, odorless, tasteless powder, and used for the same purpose as washed sulphur but is more active and irritant; *Sublimed Sulphur* (Flowers of Sulphur), also a fine yellow powder, having a slightly characteristic odor and a faintly acid taste. It is used particularly in preparation of ointments. Sulphur is used to produce sulphur dioxide for room fumigation; in such instances, all articles to be fumigated should be wet. (Terminal disinfection, as this is called, does not enjoy the same favor as formerly.) Sulphur is also used in medicine in the form of sodium thiosulphate and sodium sulphate (for use, see SULPHURIC ACID).

P. N. L.

SULPHUR FLOWER (*Eriogonum umbellatum*), a white, woolly perennial of the buckwheat family native to mountains and dry elevated valleys from



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

SULPHUR FLOWER

Single flower and flower clusters (umbels)

Colorado and Wyoming to California and Washington, growing usually at 4,000 to 9,000 ft. altitude. From the branching woody base, surrounded by numerous small leaves, rise naked flower-stalks, 4 to 12 in. high, bearing at the summit several long-stalked umbels of brilliant, sulphur-yellow, drooping flowers.

SULPHURIC ACID, a highly corrosive liquid chemical (formula H_2SO_4), colorless and odorless when pure and undiluted, weighing 114.7 lbs. per cu. ft., and containing 81.63% sulphur trioxide and 18.37% water. It mixes with water in all proportions. Dilute solutions actively corrode most metals, but lead, gold and platinum are resistant. Concentrated solutions decompose and char organic substances as wood and leather. It is produced by oxidizing sulphur dioxide (obtained by burning SULPHUR or a sulphide ore in air) and combining the

oxidized product with water. There are two classes of manufacturing process.

I. Nitration Processes.—Of these the chamber process is typical. Sulphurous gas, containing from 4 to 11% sulphur dioxide, is conducted through a dust precipitator at about 900° F. and into the bottom of a Glover tower,—a tall structure resistant to acid and heat and packed with brick checkerwork. Here the gases, ascending, encounter a descending mixture of 62% acid from the chambers and nitrous vitriol from the Gay-Lussac tower, thereby cooling the gases to about 210° F., concentrating the chamber acid to 78%, and driving nitrogen oxides out of the nitrous vitriol into the gas stream, which proceeds into a series of lead chambers. It is assumed that here the nitrogen oxides react with sulphur dioxide and water to form nitrososulphuric acid, and that the latter then reacts with more water, introduced through atomizers, to form sulphuric acid (simultaneously regenerating nitrogen oxides) and that this cycle is repeated indefinitely. Liquid sulphuric acid (66%) collects in the chamber bottoms, and the spent gases pass into a Gay-Lussac tower—a structure similar to a Glover tower—for the absorption of the nitrogen oxides in cool 78% sulphuric acid. The Gay-Lussac outflow (nitrous vitriol) is pumped to the Glover tower, where the nitrogen oxides are liberated and re-introduced into the process. The residual gases escape from the Gay-Lussac tower to the atmosphere. Since the recovery of nitrogen oxides is incomplete, the loss is replaced by introducing fresh nitrogen oxides at the Glover tower.

II. Contact Processes.—In these, the thoroughly purified sulphurous gases are blown through a converter, wherein they are contacted with certain solid substances, called catalysts (e.g., platinized asbestos, and vanadium oxide) capable of greatly accelerating the oxidation of sulphur dioxide to trioxide. As the reaction is rapidly reversible above 930° F., the gas temperatures are controlled within definite limits. The hot oxidized gas passes through heat exchangers (thereby pre-heating the incoming gases), then proceeds to gas-coolers and then to packed towers fed with recirculated 99% sulphuric acid for the absorption of sulphur trioxide. Since this absorption increases the concentration of the acid, the latter, for recirculation purposes, must be diluted continuously to about 99% strength, by the addition of water or dilute acid. The unabsorbed gases, chiefly nitrogen and oxygen, escape to the atmosphere.

The world production of sulphuric acid, basis 62%, was 23,600,000 short tons in 1929, against 13,400,000 tons in 1913. The United States produced 7,625,000 tons in 1930, against 8,338,000 tons in 1929. The 1930 consumption by the various industries of the United States was (in short tons) as follows: fertilizers, 2,350,000; petroleum, 1,485,000; metallurgical, 1,220,000; chemicals, 820,000; coal products, 800,000; textiles, 223,000; paints and pigments, 200,000; explosives, 177,000; miscellaneous, 350,000.

Medicinally, the reactions of sulphuric acid are simi-

lar to those of HYDROCHLORIC ACID. The diluted acid is used externally as an astringent. A. M. F.

SULPHUR SPRINGS, a city and the county seat of Hopkins Co., northeastern Texas, situated 83 mi. northeast of Dallas. Two railroads and bus lines serve the city. The chief crops of the region are cotton and vegetables. Poultry and dairy cattle are raised in the vicinity. Sulphur Springs is a farm trading center and has excellent yarding, meat-dressing and refrigerating facilities. Pop. 1920, 5,558; 1930, 5,417.

SULTAN, a title commonly borne by Mohammedan princes, "sultan khan" being the title given to the reigning sultan or "sultan of sultans." The title is also used of the royal princesses.

SUMACH, the common name for a large genus (*Rhus*) of trees and shrubs of the cashew family several of which produce valuable economic products or are planted as ornamentals. There are about 150 species, native chiefly to subtropical and warm temperate regions, of which about 20 are found in North America. They are mostly small, sometimes climbing shrubs or medium-sized trees with milky or resinous juice, alternate, usually pinnate but sometimes trifoliate or simple leaves, greenish, yellowish or whitish flowers, often in dense terminal panicles, and small, dry, one-seeded fruit. The species of economic value include the tan sumach (*R. Coriaria*), native to southern Europe where it is cultivated for its leaves and wood used for tanning and dyeing; the lacquer-tree (*R. vernicifera*) of eastern Asia, the source of Japan lacquer, and the Japanese wax-tree (*R. succedanea*), the crushed berries of which yield wax. In North America there are several species with poisonous foliage including the POISON IVY (*R. Toxicodendron*), the poison oaks (*R. diversiloba* and *R. quercifolia*), and the poison ash (*R. Vernix*), all of which are sometimes called poison sumach. Among those found in the eastern states are the staghorn sumach (*R. hirta*), 10 to 30 ft. high, varieties of which are widely grown for ornament; the smooth sumach (*R. glabra*), and the dwarf sumach (*R. copallina*), a low shrub in the north and a tree in the south. Among the sumachs of the Pacific states are the laurel sumach (*R. laurina*), the LEMONADE BERRY (*R. integrifolia*) and the sugar-bush (*R. ovata*), all elegant shrubs with entire evergreen leaves. See also FUSTIC.

SUMATRA, one of the Great Sunda islands of the MALAY ARCHIPELAGO, and after Borneo, the largest of the DUTCH EAST INDIES. It stretches from 5° 39' N. to 5° 51' S. lat. and is thus divided by the Equator. Sumatra has an area of 164,480 sq. mi., with nearby islands, of 180,380 sq. mi. The population with dependencies was 5,759,568 in 1925. This number is rapidly increasing, as Javanese, Chinese and a few Tamils are immigrating to Sumatra. In 1927 the total number of inhabitants had increased to 6,219,004.

Ninety volcanoes, of which 12 are active, have already been discovered on the island. These are scattered amid the series of mountain groups which, under the name of the Barison Mountains, run the whole length of the island, closely approaching the

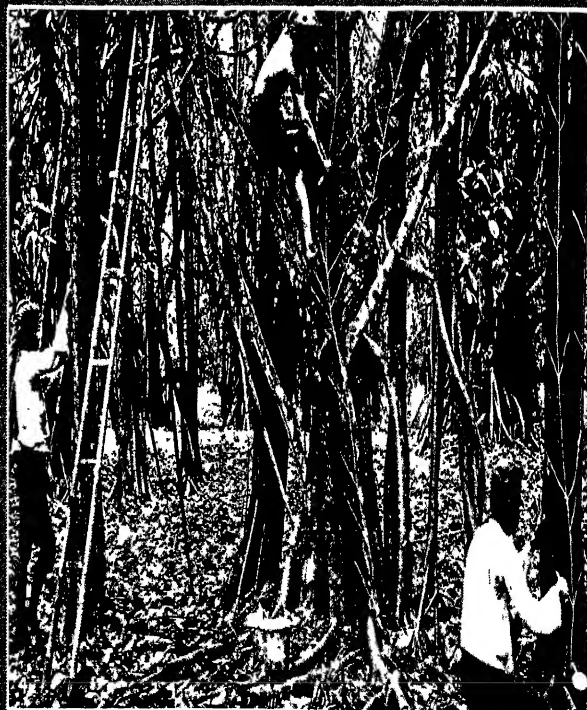
western coast and attaining their widest development in the south. Whether naked or covered with verdure, graceful or shattered by their own eruptions, grouped in twos and threes, enclosing narrow valleys, or bearing in their craters a great lake of water, these volcanoes are the creative, the regulating and often the perturbing factors of the orographic and hydrographic history of the land. Their average height runs from 9,000 to over 12,000 ft. These linear belts of volcanoes are covered to their summits with large forests. On the lower mountains are woods here and there, and these are commonly adorned with the wine-yielding Areng palm (*Arenga saccharifera*).

The great alluvial plain which occupies the entire western portion of the island is about 700 mi. long and from 50 to 200 mi. wide. It is intersected with large and navigable rivers, by means of which trade is carried on almost to the opposite shores of the island. Sumatra abounds in lakes; the largest of them is Lake Toba, 45 mi. long and 15 wide.

One of the most characteristic features of the flora is the superabundance of rank and worthless grasses called *lalang* and *glaga*. Among the plants are the Rafflesias, with the largest flower known, the blossom of *Rafflesia Patma* measures 20 to 24 in. in diameter; that of *R. Arnoldi* attains a diameter of 36 to 40 in. The flower was discovered by the naturalist, Joseph Arnold, in 1818, and named after Sir Stamford Raffles, Lieutenant-Governor of Java during the English occupation. Sumatra possesses a great variety of forest timber, including the pine, *Pinus Merkusii*, not found elsewhere in the East Indies. The forests produce gums and resins of great commercial value. Camphor, rubber, pepper, cinnamon, benzoin and lacquer are found in abundance.

In the center of the island and on the northwestern coast the elephant is native, and the rhinoceros, tiger, panther, tapir and a few orang-utan are found. The enormous tracts of fertile soil produce pepper, coffee and rice in large quantities. The town of Padang, near the center of the west coast, is surrounded by coffee plantations. The best tobacco lands are on the other side of the island; a large quantity is raised about Deli, on the Strait of Malacca. The leaf is especially valuable for wrappers, the best being sent to Europe and thence to Cuba, to be used for the finest of Havana cigars. In recent years there has been a rapid development in rubber, palm-oil, tea and tobacco. The minerals include the rich coal-fields of Ombilin, which are situated towards the head waters of the Batang Hari. Gold mines are widely distributed. Tin, copper, silver and iron have been mined and the crude petroleum output amounts to about 600,000 tons annually.

The Arabs, who came in the 13th century, are recorded as the first civilized invaders of the island. In 1292, Marco Polo touched at Sumatra. The Dutch settled on the island in the 16th century after driving out the Portuguese who had established a trading post. In 1685 a settlement was formed by the British who seized the Dutch possessions in 1811. These



1, 2, ORIENT AND OCCIDENT PHOTOS; 3, 4, JOHN EDWIN HOGG PHOTOS, FROM ORIENT AND OCCIDENT

PRIMITIVE LIFE IN THE TRIBAL VILLAGES OF SUMATRA

1. Bullocks pulling a cart across a ford in a stream. 2. Sampans at the landing place of a village on Lake Toba, northwestern Sumatra.
3. Houses of the Battaks, a Christianized tribe. 4. Malays tapping rubber trees in the Sumatran jungle.

were restored four years later, and by treaties the Dutch were allowed the right to hold and enlarge their possessions. In 1883 a tidal wave caused great destruction on the south coast of the island.

SUMBA or **SANDALWOOD**, an island of the Dutch East Indies, belonging to the Lesser Sunda group and forming part of the residency of Timor. It has an area of 4,300 sq. mi. and is dominated by hills rising to 3,000 ft. above the sea. The island is particularly noted for the forests of sandalwood which cover the hills, and for the rich pastures where excellent horses and cattle are bred. Rice, coffee, tobacco and maize are grown. Est. pop., about 124,500.

SUMBAWA, an island of the Dutch East Indies, belonging to the group known as the Lesser Sunda Islands and forming part of the residency of Timor. It lies immediately east of Lombok and has an area of about 5,000 sq. mi. Volcanic mountains traverse it, the highest peak, Mt. Tambora, which rises 9,042 ft. above sea level, still being an active volcano. In 1815 this cone was the scene of an eruption. The principal products of Sumbawa are rice, tobacco and sandalwood. Sumbawa and Bina are the chief towns. Est. pop., 246,000.

SUMDUM, one of the tribes of the Tlingit, an important group of the North American Indian Kolutshan linguistic stock. They occupy a village called by the same name at Port Houghton, Alaska.

SUMER AND AKKAD. See **BABYLONIA AND ASSYRIA, HISTORY OF.**

SUMERIAN, a language of unknown linguistic affinities spoken by the earlier non-Semitic inhabitants of southern Babylonia (Sumeria), preserved in inscriptions and clay-tablets from about 4000 B.C. onward. Sumerian is an "agglutinative" language (see **AGGLUTINATION**): its roots, generally monosyllables, do not undergo internal changes, but are modified by adding suffixes, infixes and prefixes, each of which maintains its separate identity. The script, which is **CUNEIFORM**, consists of four vowels and 14 consonants. In the pronouns of the first and second persons, which are also used as enclitics, and in the noun, Sumerian does not distinguish **GENDER**, which it expresses either by placing the determinative "male" or "female" before the noun, or by employing entirely different words. The noun distinguishes four **CASES**, formed by suffixing vowels or syllables—nominative, genitive, dative and accusative (locative); the plural, when indicated, is formed either by a duplication of the root or by the suffixes *-ene* and *-mes*. Sumerian was spoken at least until the period of Hammurabi (2000 B.C.); and the script, which was adopted in **ACCADIAN**, was in use until about 100 B.C.

I. M.

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SUMMERALL, CHARLES PELOT (1867-), American army officer, was born near Lake City, Fla., Mar. 4, 1867. Graduated from the United States Military Academy in June, 1892, he served

with distinction in the Philippines, and in China during the Boxer Rebellion. In the World War, in command of the First Division, he took part in the Aisne-Marne, the St. Mihiel, and the Meuse-Argonne offensives. He was awarded the Distinguished Service Cross and Medal, and the Croix de Guerre. In 1919 he was appointed brigadier-general in the regular army, and in 1920 major-general. He was made chief-of-staff in 1926, and general in 1929. Retired in 1930, he accepted the presidency, in Sept. 1931, of The Citadel, the military college of South Carolina. He was editor of the military science department for the *National Encyclopedia*, 1932.

SUMMER SCHOOLS include the short sessions held at universities or schools during summer months, and schools which are open only during the summer, as chautauquas. The university summer sessions are primarily for those who can take courses only during a short period of the year, as teachers or others engaged in business. Credit toward a degree is frequently given for completion of this work. The summer sessions in public schools, aside from the purely recreational centers, are planned for those who wish to complete their courses in a shorter time than the regular period and for those who have failed in certain subjects.

Harvard was the first university in America to open a summer course, this being in 1869. In 1874 a short session was held at Chautauqua, N.Y., which led to provision for a four-quarter university year at the University of Chicago. Summer sessions vary from 5 to 12 weeks, the latter being the quarter session mentioned above. The summer courses are planned for highly concentrated work during the short session. Attendance in summer schools throughout the country has increased markedly during the last few years, the increase being even greater than in the regular university sessions. In 1929-30 there were 249,050 students registered in summer schools of university rank in the United States.

SUMMERSIDE, a seaport and tourist resort of Canada, situated in Prince East Co., Prince Edward Island, about 36 mi. northwest of Charlottetown, and 124 mi. directly northwest of Halifax, N.S. Regional farm produce, silver fox pelts and the celebrated Malpeque oysters are largely exported. Summerside is the terminus of a steamer service between the mainland and Prince Edward Island. Pop. 1921, 3,228; 1931, 3,759.

SUMMERVILLE, a town and winter resort in Dorchester Co., southeastern South Carolina. It is situated about 25 mi. northwest of Charleston and is served by the Southern railroad. Summerville is surrounded by truck and cotton-growing country, and has a lumber mill and an azalea nursery. The town has fine golf links, bridle paths and camellia and azalea gardens. The country club is built on an estate which was formerly a tea-farm, one of the very few in the United States. Pop. 1920, 2,550; 1930, 2,579.

SUMMIT, a city in Cook Co., northeastern Illinois, situated 11 mi. southwest of Chicago, on the Illinois

and Michigan Canal. It is served by the Chicago and Alton Railroad. The city has factories producing automobiles, asphalt shingles and corn products. Summit was founded by Marquette and Joliet in 1634; incorporated in 1890. Pop. 1920, 4,019; 1930, 6,548.

SUMMIT, a city of Union Co., N.J., situated among a series of hills known as the second Watchung Mountains and bounded on the northwest by the Passaic River, 21 mi. west of New York City and 10 mi. west of Newark, N.J. It is served by the Lackawanna and the Rahway Valley railroads and by motor bus lines. A residential community, Summit is the suburban home of many prominent New York and Newark business men; and it is characterized by winding, shaded streets and sloping lawns. In 1929 the value of the factory output was about \$1,000,000; the retail trade amounted to \$11,453,384. It was incorporated as a separate township in 1869 and was granted its charter as a city in 1899. Pop. 1920, 10,174; 1930, 14,556.

SUMMIT HILL, a borough in Carbon Co., eastern Pennsylvania, situated about 25 mi. northwest of Allentown, in an important anthracite coal field. It is served by the Lehigh and New England Railroad and a switch-back line running to Mauch Chunk, the latter used only in summer. Summit Hill's chief industry is coal mining. Located here is the noted Burning Mine, which has been on fire for more than 100 years. The Mauch Chunk Switch-Back Railroad, said to be the oldest American railroad, was built in 1827 to carry coal; now it chiefly accommodates tourists. Pop. 1920, 5,499; 1930, 5,567.

SUMMONS, a writ directed to the sheriff or some proper officer commanding him to notify the person or persons named in the writ of an action brought against him or them and calling on such person or persons to appear at a time specified and make answer to the complaint. Simpler forms of notice have been introduced in many jurisdictions by statute, as, for instance, a notice of suit served by or on behalf of the plaintiff.

SUMMUM BONUM, an ethical principle, literally the highest or greatest good. What is conceived to be the summum bonum varies with different ethical philosophies, depending on the ethical standards adopted. Thus the principles of universality, perfection, harmony, self-realization and the good will may all enter into a determination of the greatest or the highest good. See **ETHICS**.

SUMNER, CHARLES (1811-74), American statesman, was born in Boston, Mass., Jan. 6, 1811. He was educated at the Boston Latin School and at Harvard University, graduating from the latter in 1830. He graduated from Harvard Law School, 1833, and, upon his admission to the Massachusetts bar the following year, began the practice of law in Boston. He lectured at the Harvard Law School, 1835-37. From Dec. 1837 until May 1840 he traveled extensively in Europe. In 1846 he made his refusal of the proffered Whig nomination for Congress the occasion for a denunciation of slavery and

reproved the party for their tolerance of it. Sumner publicly lamented the Mexican War and in 1848 was one of the founders of the Free-Soil party. He was an unsuccessful congressional candidate of his party the same year.

Sumner was elected to the U.S. Senate in 1851 by a coalition of the Democratic and Free-Soil parties and was reelected as a Republican in 1857, 1863 and 1869, serving continuously from 1851 until his death. He fiercely opposed the passage of the Kansas-Nebraska Act (1854) and persistently attacked slavery. Sumner delivered his speech, "The Crime Against Kansas," May 19-20, 1856 in the Senate in an effort to prove convincingly the viciousness of the defense of slavery as well as of the institution itself. Alleging insulting remarks in the speech about an aged uncle, Representative Preston Brooks of South Carolina on May 22, 1856, attacked Sumner with a cane as he was seated at his Senate desk and beat him so severely that the injuries necessitated Sumner's absence until Dec. 5, 1859. Sumner became chairman of the Senate committee on foreign relations Mar. 8, 1861.

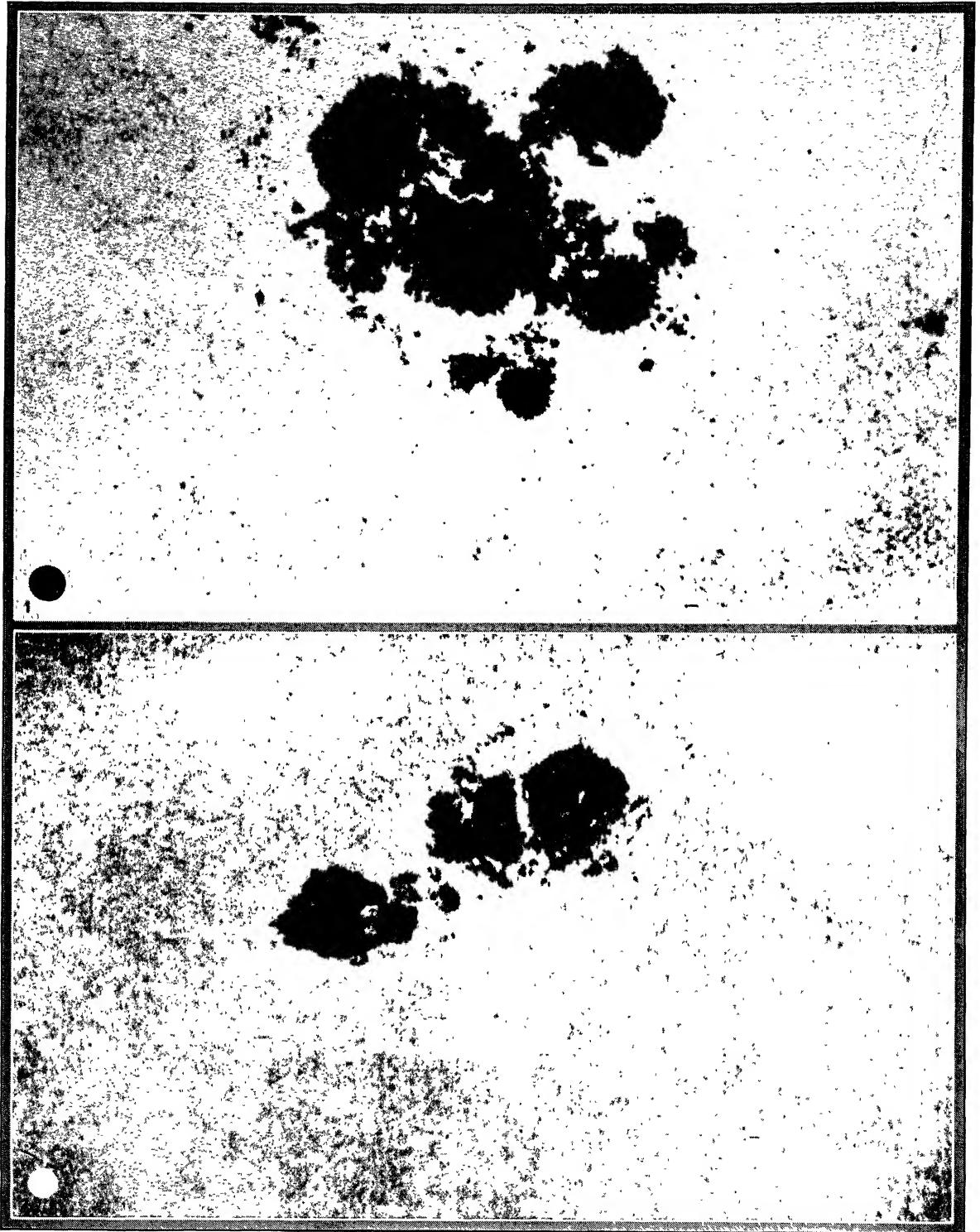
During the Civil War Sumner favored early emancipation of the slaves and he later advocated a reconstruction policy which was chiefly concerned with the assuring of equal rights to the freed men. He was hostile to Andrew Johnson and urged his impeachment. As chairman of the Committee on Foreign Relations Sumner pushed the Alabama Claims against England, and by his opposition helped to defeat the proposed annexation of Santo Domingo by the United States. From the decade of the 50's until his death he publicly lectured on a variety of national and international subjects. He died in Washington, Mar. 11, 1874.

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SUMNER, WILLIAM GRAHAM (1840-1910), American clergyman and sociologist, was born at Paterson, N.J., Oct. 30, 1840. Graduating from Yale in 1863, he studied at Geneva in 1863-64 and at Göttingen during 1864-66. In 1869 he became assistant rector of Calvary Church, New York City. In 1872 he returned to Yale as professor of political and social science, retiring as professor emeritus in 1909, in which year he was president of the American Sociological Society. He published a number of economic and sociological studies, and was celebrated for his brilliant advocacy of free trade. He died at Englewood, N.J., Apr. 12, 1910.

SUMTER, a city and the county seat of Sumter Co., central South Carolina. Four railroads and bus lines serve the city. There is an airport. Cotton, corn and tobacco are the chief crops of the region. Woodworking and furniture manufacture are the principal industries. In 1929 the retail trade amounted to \$6,835,533. The vicinity has fine lumbering country. The city was founded in 1785, and was named for Gen. Thomas Sumter, "The Gamecock of the American Revolution," whose home was in the vicinity.

SUN



COURTESY MOUNT WILSON OBSERVATORY

PHOTOGRAPHIC STUDIES OF SUN SPOTS

1. Great sun spot group, photographed on Aug. 8, 1917. The small disc in the lower left corner represents the earth.
2. Large sun spot group, photographed on June 17, 1907. The disc represents the size of the earth.

The Battle of Dingle's Mill in 1864 was fought near Sumter. The city adopted the commission-manager form of government in 1912. Pop. 1920, 9,508; 1930, 11,780.

SUN, the central and dominant body of the planetary or solar system 92,870,000 miles distant from the earth. It is a self-luminous sphere 864,100 miles in diameter, or 109 times that of the earth. The sun's volume, therefore, is 1,300,000 times greater than that of the earth, its mass is 330,000 times greater. From these facts its density is calculated to be 1.4 times that of water. The sun rotates on its axis, but not as a solid body. The mean period of rotation on the equator is 24.65 days, while that in latitude 35° is 26.63 days and that near the poles 34 days. The higher latitudes lag behind, and a straight line drawn on the sun from pole to pole would look at the end of a year like a corkscrew.

The luminous surface of the sun which is visible through a telescope is called the **PHOTOSPHERE**. Its temperature is about 10,000° F, and it is surrounded by the **REVERSING LAYER**, a few hundred miles thick, and composed of the gases of many chemical elements known on earth. The next, and more tenuous part of the sun's atmosphere, the **CHROMOSPHERE**, extends for several thousand miles, and consists chiefly of the lighter gases, such as hydrogen and helium. It can be studied to best advantage for a few instants at the beginning and at the end of a total eclipse of the sun, when the moon has covered all of the photosphere but not all of the chromosphere. It is from the chromosphere that the **PROMINENCES** originate, huge crimson colored flames of hydrogen, rising sometimes to as much as 400,000 miles in height.

Outside the chromosphere lies the **CORONA**, the outermost part of the solar atmosphere, of extreme tenuity, irregular and varying in shape, extending to well over a million miles above the sun's surface. It is visible only during a total eclipse of the sun. Its total brightness is estimated as about half that of the full moon, or one-millionth of that of the sun. The temperature of the corona may be around 5,000° F, that of the chromosphere about 8500° F.

When viewed through a telescope, the most conspicuous features of the sun are usually the sun-spots. One sees a jet-black, irregularly-shaped central part, the umbra, and a grayish surrounding ring, the penumbra. In the smallest sun-spots observable, the umbra may be only 500 miles in diameter; in the largest it may range up to 5,000, while the penumbra sometimes reaches 150,000 miles across. A sun-spot is in reality a vortex of hot gases, shot upwards from the sun's interior, and cooling off through the sudden expansion when it reaches the surface. It appears black, only by contrast with the more brilliant photosphere.

Sun-spots partake of the sun's rotation but usually are too short-lived to be visible a second time, after the rotation has carried them clear around. The frequency of sun-spots is subject to an eleven-year cycle, during which time they alternately become

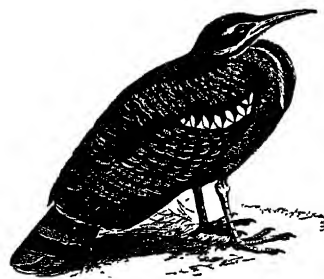
visible in great numbers and disappear entirely from the sun's disk for days at a time. In addition, sun-spots constitute huge magnets, whose influence is often felt on the earth, causing severe magnetic storms as well as displays of aurora borealis.

From the amount of heat received from the sun at the earth's surface, 12 calories per square inch per minute, it can be calculated that the sun is radiating more than half a million million million horsepower. According to the theory of relativity, the sun is losing mass through this radiation at the rate of 4,700,000 tons per second; but even at this prodigious rate it would not lose more than 1/15,000 of its present mass in a billion years. However, to explain the continuous production of this energy it has been necessary to assume that annihilation of matter takes place in the sun's interior, in such a way that electrons and protons, colliding with each other, completely lose their mass and disappear as radiant energy. This in turn has indicated a time scale in which the past luminous life of the sun may be counted in millions of years. W. J. L.

SUN BATHS. See **HELIO THERAPY**.

SUNBIRD, the common name for a family (*Nectariniidae*) of over 100 species of small Old World birds in appearance and habits somewhat resembling the hummingbirds, but in structure allied to the honey eaters and flower peckers. They are found chiefly in Africa, but also in India and Australia. They have bright colored plumage, often with a metallic luster, long usually downwardly curved bills, and long protractile tongues. Active and arboreal in habit, they seek their food, which consists chiefly of insects and spiders, among the branches of shrubs and trees. Their notes are mostly shrill and unpleasant. The handsome oval or pear-shaped nests of the sunbirds, in which are laid usually two spotted whitish eggs, are suspended from the end of a branch or the underside of a leaf and provided with a roof to protect the opening.

SUN BITTERN, the common name for a small family (*Eurypygidæ*) of peculiar New World birds



BRAZILIAN SUN BITTERN

allied to the cranes. They are about 18 or 20 in. long, somewhat resembling in appearance both the rails and the herons. Their soft plumage is generally brown above, handsomely marked with black, gray and

white. Moving singly or in pairs, sun bitterns inhabit the wooded banks of tropical rivers, where they take delight in sunning their fine plumage. They feed largely upon insects which they secure by a rapid dart of the long neck. There are two known species, one (*Eurypyga helias*) found in Guiana and Brazil and the other (*E. major*) in Central America and Colombia.

SUNBURY, a city in eastern Pennsylvania, the county seat of Northumberland Co., situated at the meeting of the northern and western branches of the Susquehanna River, 42 mi. north of Harrisburg. It is served by three railroads. There is an airport. Farming is carried on in the vicinity. Near by are coal, shale and gravel deposits. Sunbury is a shipping point for coal and lumber, and a manufacturing center, turning out silk, dye stuffs, foundry products, cigars and other commodities. The manufactured output, 1929, was worth \$13,520,218. The retail business in 1929 was valued at \$7,130,495. The city is built on the site of the Indian village of Shamokin. A Moravian mission was established here in 1747. Ft. Augusta was built in 1756, and became a place of safety during the Wyoming Massacre. Sunbury was laid out in 1772; chartered as a city in 1922. Pop. 1920, 15,721; 1930, 15,626.

SUNDA ISLANDS, that group of islands extending from the MALAY PENINSULA to the MOLUCCAS. The group includes Sumatra, Borneo, Java, Celebes, Bali, Billiton, Lombok, Sumbawa, Sumba, Flores, Timor and many lesser islands. These separate the China and Java seas on the north from the Indian Ocean in the south. The Strait of Sunda, a narrow channel between the islands of Sumatra and Java, connect the Indian Ocean with the Java Sea. Near the center of this strait is the island of KRAKATOA, an oceanic volcano which in 1883 was the scene of a catastrophic eruption.

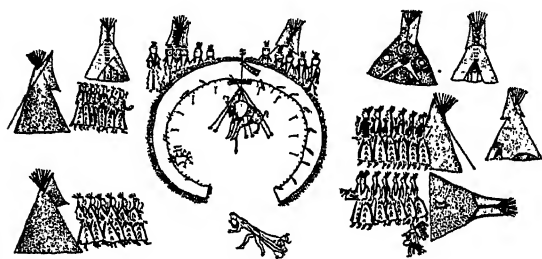
SUN DANCE, a complex ritualistic tribal ceremony performed by all the typical Plains Indian tribes with the exception of the Comanche. The name by

ture of the ceremony. The ceremony was held at the time of the summer buffalo hunt when the tribe was gathered in a great camp circle and was initiated by either a man or woman, in accordance with a vow made during some period of stress or danger. It was believed to be a valid method of acquiring supernatural power. The public ceremonies were preceded by varying periods of preparation and instruction to the novice during which regalia and other paraphernalia were prepared and the special face and body painting and attendant songs were learned. Food was prepared and the poles and brush brought in for the erection of the special ceremonial lodge. The selection and erection of the center pole, called the sun pole, were important features of the ceremony since scouts were sent out for the tree, coup was counted on it (*see* COUP COUNTING) it was cut down, the entire procedure being like the treatment of an enemy in battle.

With the raising of the center pole to which offerings were tied and the erection of the sun dance lodge, the ceremony proper began. An altar was erected in the lodge. The central figures in the ceremony, the persons who made the vow and others associated with them, fast for a period before or during the ceremony. They dance, with intervals of rest, for several days and nights. This ceremony of sacrifice then arrived at its most spectacular phase, the so-called torture already mentioned, during which skewers were thrust through the skin and the dancers were suspended or danced until the skin tore away. The details of procedure naturally vary from tribe to tribe, but the sun dance was known in its most complete form among the Arapaho.

SUNDAY, WILLIAM ASHLEY (1863-), American evangelist, was born at Ames, Ia., on Nov. 19, 1863. He was educated at Nevada, Ia., and at Northwestern University. From 1883 to 1890, he played professional baseball with the Chicago, Pittsburgh and Philadelphia teams in the National League. From 1891 to 1895 he served as assistant secretary of the Chicago Y.M.C.A., and in 1896 started his evangelistic work. He has estimated the number of his converts to have been often as high as 3,000 a month in the first decade of the 20th century. In 1903, he was ordained by the Chicago Presbytery and has received the degree of D.D. from Westminster College, New Wilmington, Pa. Since 1913, when he achieved unusual success in Philadelphia, he has conducted services in the chief cities of the United States. He is an ardent supporter of Prohibition. Since 1920 he has lived at Winona Lake, Ind., where he conducts revivals in connection with summer Chautauqua programs.

SUNDAY SCHOOLS, religious educational organizations which conduct Sunday classes taught by volunteer teachers. They did not originate with the necessity for religious education, but came into existence as a philanthropy for uneducated children in the 18th century. The first Sunday School, so named, was established by Robert Raikes (1735-1811), the



COURTESY AMER. MUS. OF NATL. HISTORY

SUN DANCE OF THE DAKOTA INDIANS

From a painting by Short-Bull, chief of the Oglala Dakotans, representing the dance as it was about 1890

which the ceremony is generally known is derived from the Dakota *wiwanyag wacipi*, meaning "sun-gaze dancing," and refers specifically to one phase of the ceremony during which the participants may gaze steadfastly at the sun during the so-called torture fea-

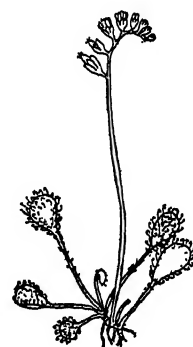
proprietor of the *Gloucester Journal* in England. In 1780 he printed in his newspaper an announcement of the establishment of his school which was copied by the London press and awakened general attention to the subject throughout the country. Five years later the Society for the Establishment and Support of Sunday Schools was founded. One of its main expenses was for payment of the teachers, a practice discontinued as the movement grew. The first Sunday School in the United States was established in 1791 by the First-Day School Society of Philadelphia, and the American Sunday School Union was founded in 1824.

From these beginnings the movement spread throughout the world chiefly among the Protestant denominations. World Conventions have been held every five years in the leading cities of various countries, the first being in 1889 in London. At the convention in Rome in 1907, the World's Sunday School Association was organized, and in 1931 it was estimated that there were approximately 350,000 Sunday schools, with a total membership of 40,000,000 pupils and 3,000,000 teachers and officers. In the United States approximately 20,000,000 pupils were organized in nearly 200,000 Sunday Schools holding about 70,000 classes. About 80% of the nearly 200,000 churches in the United States possess Sunday schools. Although only about 50% of the Roman Catholic churches have such classes, these churches reach about 2,000,000 children through the religious instruction given daily in their PAROCHIAL SCHOOLS. About 20% of the Jewish congregations reach their young people through Talmud Torah schools.

SUNDERLAND, a seaport on the west coast of England, in Durham, at the mouth of the Wear, 260 mi. north of London. The harbor and docks cover an area of about 155 acres, with an entrance formed by two granite piers. There is extensive ship-building and manufacturing of marine engines, glass and earthenware, ironwork and rope. Coal is the chief export. The most important ecclesiastical building is St. Peter's, an ancient church on the site of the monastery in which the Venerable Bede was educated. The principal public buildings are the town hall, built 1887-1900, in Italian Renaissance style, the museum and the art galleries. Sunderland is a well-built town, with broad streets, beautiful suburbs, magnificent parks and fine promenades. The parliamentary borough of Sunderland was extended in 1927; it now comprises the townships of Bishopwearmouth and Monkwearmouth, the total area being 3,000 acres. Pop. 1921, 182,179; 1931, 185,870.

SUNDEW, the common name for a large genus (*Drosera*) of insectivorous plants of the sundew family. There are 90 species found in bogs widely throughout tropical and temperate regions, seven of which occur in North America. They are low herbs, usually with creeping rootstocks and leaves in a basal rosette from which rises a slender naked flower-stalk bearing numerous small flowers in a one-sided cluster opening only in sunshine. The elongated or circular

leaf blades are thickly set with curious tentacles ending in somewhat globular reddish heads that secrete a glistening, more or less honeylike fluid. Various small insects, especially flies, mistaking the fluid for honey become entangled in it whereupon the tentacles, by an inward and downward movement, at length place the insect upon the surface of the leaf. Other tentacles bend downward at the same time smothering the insect and secreting a digestive enzyme which enables the leaf to assimilate the proteids of the insect's body and utilize them for plant food. See also CARNIVOROUS PLANTS.



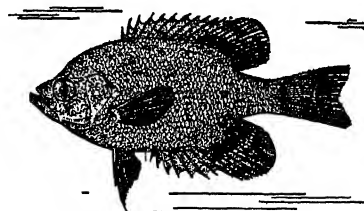
P. A. RYDBERG "FLORA OF PRAIRIES AND PLAINS"

COMMON SUNDEW
Drosera rotundifolia

SUN-DOGS or Mock-Suns, the name given to hazy patches of light formed on either side of the sun at the intersection of the principal circle of a HALO with the parhelic circle.

SUNDROPS, a name given to various species of evening primrose (*Oenothera*) with showy, bright yellow flowers opening in the sunshine, several of which are grown as garden ornamentals. Among the best known are the common sundrops (*O. fruticosa*) with flowers sometimes 2 in. across; the small sundrops (*O. pumila*) with flowers an inch broad, and the narrow-leaved sundrops (*O. linearis*) with similar flowers, all of which are native to the eastern United States and more or less cultivated.

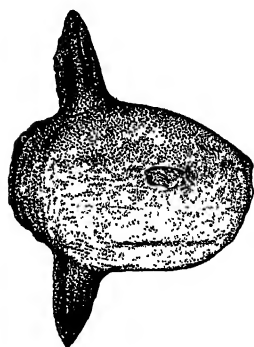
SUNFISH, a family (*Centrarchidae*) of well-known North American food and game fishes, allied to the perches, found widely in ponds and streams chiefly east of the Rocky mountains. For the most part they are handsome fishes with deep, compressed



LONG-FINNED SUNFISH
Centrarchus macropterus

bodies and brilliant metallic coloration. They feed upon worms, crustaceans and small fishes; most species build nests and guard the eggs and young with great care. The common sunfish or pumpkin seed (*Eupomotis gibbosus*), which ranges from the Great Lakes region to Maine and to Florida, is usually about 8 in. long and weighs half a pound. It is olive-green above, bluish spotted with orange on the sides and orange below. Because it is easily caught and makes a fair

pan fish it is a favorite with young anglers. In 1929 the commercial catch of sunfish in the United States was 926,000 lbs. valued at \$42,000. The name sunfish is applied also to a very large marine fish (*Mola mola*), found widely in warm and temperate seas.



OCEAN SUNFISH

SUNFLOWER, the common name for a large genus (*Helianthus*) of conspicuous annual and perennial herbs of the composite family several of which are grown for economic purposes or for ornament. There are 60 species, natives of the New World, about 50 of which grow in North America. They are usually rather course plants with simple

leaves opposite below and alternate above. The large solitary or clustered flower-heads, which terminate the stem and branches, consist of an outer leafy involucre and many conspicuous yellow rays surrounding a broad central disk.

The common sunflower (*H. annuus*), the state flower of Kansas, is native from Minnesota to Texas, west to Washington and California. It is a robust, rough-hairy annual, 3 to 12 ft. high, with long-stalked, ovate, toothed leaves, a foot in length, and flower-heads 3 to 6 in. broad with a brown-purple disk; it is widely cultivated for ornament and for its oily seeds, especially in southern Russia where it is extensively used for poultry food. In the United States it is grown sparingly for its seeds and also as a fodder plant used chiefly as ensilage. In cultivation it sometimes grows 17 ft. high with flower-heads 14 in. across.

Other valuable species are the girasole or JERUSALEM ARTICHOKE (*H. tuberosus*), cultivated for its tubers, and the Indian potato (*H. giganteus*) with very fleshy roots.

SUN FO (1891-), Chinese political leader, was born in Kwangtung, being the son of Sun Yat-sen, by his first wife. He holds a B.A. degree from the University of California, 1916, and an M.S. from Columbia, 1917. He served in various capacities, including that of mayor of Canton, while his father was leader of the Nationalist movement, and became Minister of Communications, and subsequently Minister of Railways in the Nationalist Government at Nanking. He resigned the position to join the Canton group at the time of the breach in the spring of 1931. When the Chiang government fell in Dec., 1931, Sun Fo became head of the executive council in the new regime.

SUNKEN BELL, THE (*Die versunkene Glocke*), a symbolical play in blank verse by GERHART HAUPTMANN; produced 1896. Heinrich, a master bell founder, achieves a cherished ideal when he hangs his finest bell in a mountain chapel. But the bell,

angering a mountain spirit or fairy, is sunk in a deep abyss. Heinrich is assisted by a good fairy, Rautendein, and in her finds new hope, but at last he is worn out by his unequal struggle. As a poetic allegory, the play is moving though somewhat vague. It stands at the forefront of the European dramas of symbolism in vogue at the end of the 19th century, but most critics rank it below Hauptmann's earlier, more naturalistic productions.

SUNLIGHT. See NATURAL LIGHTING.

SUNN HEMP, a valuable cordage fiber, called also Bombay or Madras hemp, produced extensively in southern Asia, especially in India. It is obtained from the inner bark of a species of rattlebox (*Crotalaria juncea*), native to the warmer parts of Asia and widely cultivated. It is a shrubby plant of the pea family, 8 to 12 ft. high, with narrow silky-silvery leaves, handsome bright yellow flowers, and club-shaped pods containing kidney-shaped seeds. After being cut the stems are steeped in water to loosen the bark. They are bent so as to break the interior wood without injuring the fiber which is washed with water until completely separated. The fiber after being dried is combed to straighten the filaments.

SUNNITES, or the Sunnis, a designation for the main body of Moslems who represent the *sunna*, "use, custom," etc., after the manner of Mohammed himself and the legitimate succession. Probably 90% of the Moslem world is Sunnite, embracing, however, parties as widely varied as orthodoxy has allowed. There are, for example, four recognized schools of Canon Law, those of Malik, Abu Hanifa, as-Shafii, and Ibn Hanbal. The leadership of the Sunnite world has been, until recently, in the hands of khalifs who were, at first, elected to office, and later, i.e., their successors were vested with authority either by heredity or "the accomplished act." The main elements in the *sunna* are Mohammed's deeds, utterances, and whatever has been considered from time to time as having his approval. It would seem to be something in addition to the KORAN, although in harmony therewith.

SUNSET CRATER, a national monument near the famous San Francisco Peaks north of Flagstaff, Ariz. This tract of 3,040 acres within the area of the Coconino National Forest was set aside by presidential proclamation May 26, 1930. The monument contains a volcanic crater with lava flows and ice caves which are of great scientific as well as public interest. From Flagstaff, Ariz., on the Atchison, Topeka, and Santa Fé Railroad and the National Park-to-Park Highway, a natural road leads 18 mi. north to the monument.

SUNSHINE, in meteorology, is conventionally limited to the radiation of heat and light from the sun when the sky is not too thickly covered with clouds to permit at least the outline of the sun's disk to be observed. It is one of the most important items in the meteorological conditions that constitute climate. The total length of time during which the sun is above the horizon, added up over the whole year, is the same over the entire earth. It is there-

fore its distribution over the different months, which is uniform on the equator and very one-sided at the poles, as well as the amount of time that the sun actually shines, expressed as a percentage of the total, and again taken in relation to the seasons, that are of importance. The character of the sunlight is likewise taken into consideration. For example, in foggy climates at sea level only the heat rays of the sun penetrate, while in high altitudes under a clear sky sunlight still contains a fair amount of ultra violet rays, of much therapeutical value.

The simplest sunshine recorder consists of a glass sphere which focusses the sun's rays on a curved card, upon which graduations are marked. Whenever the sun shines with full strength, its light will make a burned spot on the card, and the length of the line, traced by these burned spots, marks the duration of sunshine.

SUN SPOTS, dark markings on the sun's surface, formed by a vortex of gases rising to the surface and cooling off in the process. See SUN.

SUN-STAR, the popular name for members of a genus (*Solaster*) of large sea-stars (*Asteroidea*) which usually live in the shallow shore waters of temperate seas. All of them have more arms than do most sea-stars, some have more than 30. Two species are familiar on both coasts of the United States and in Europe. The common sun-star (*Solaster papposus*) has from 8 to 14 arms, and may be 12 inches across. It is orange or red in color. The purple sea-star (*Solaster endeca*) has from 7 to 13 arms, and may be 14 inches across.

SUNSTONE. See AVENTURINE; OLIGOCASE.

SUNSTROKE AND HEATSTROKE, those conditions that follow exposure to excessive heat.

Sunstroke is more common in men than in women and children, and is seen principally in persons exposed to the sun, who are too heavily clad or who are addicted to alcohol. High humidity favors its occurrence.

The individual with sunstroke may die within an hour with symptoms of heart failure and shortness of breath. The more usual type comes on with headache, dizziness, a feeling of oppression and sometimes nausea and vomiting. Diarrhea and frequent urination may be present. Insensibility follows which may last a short time or deepen into unconsciousness. The face is flushed, the skin hot, and the heart beat rapid. The temperature may range from 107° to 110° F. and death may result in from twenty-four to thirty-six hours. On the other hand, the temperature may drop, consciousness return and the patient recover. (See also FEVER.)

True *heat exhaustion* produces somewhat dissimilar symptoms. It is seen especially in persons who have not been in good health or who are intemperate. The heat may be that of the sun or artificial such as in the engine room of a steamer.

The symptoms begin with giddiness, nausea, an uncertain staggering gait. There is pallor, the heart beat is weak, and breathing is rapid. The patient

may quickly become unconscious. Muscle spasms are often present. The body feels clammy and there is usually sweating, but the temperature is below normal. The individual usually recovers from a slight attack, but in severe cases death may occur.

In sunstroke the treatment consists in measures for reducing the temperature as rapidly as possible. The body may be rubbed with ice. In heat exhaustion, stimulants should be given and, if the temperature is below normal, the patient put into a hot bath.

When exposed to high temperatures, people who do heavy muscular work are liable to attacks of severe cramp. This condition occurs in stokers, steel workers and workers in iron factories. The muscles in the calves, arms and abdomen are the ones most often affected. The attacks usually last from twelve to thirty-six hours, and are followed by muscular soreness and sometimes by great weakness. Warm baths, massage and an injection of morphine usually give relief.

W. I. F.

SUN YAT-SEN (1868-1925), leader of the Republican revolution in China, was born near Canton of village gentry stock. As a boy he went to Hawaii to be with his older brother, and there stayed in an American missionary school. He returned to China and studied medicine at Hongkong University, receiving his degree in 1892. He started practice in Macao, but very soon gave this up, to engage in a career of active revolution against the Manchu Dynasty which then was ruling in China. He and some youthful associates organized an unsuccessful revolt at Canton in 1895. During the subsequent years Sun Yat-sen was busily occupied in anti-Manchu agitation, principally among the Chinese outside of China, but also in China itself. In this work he built up an organization, which later became the Kuomintang, and was modeled to a large extent on the older Chinese secret societies. The Manchu authorities put a price on his head, and several attempts were made to assassinate him during this period.

As a result of dissatisfaction at Hankow, growing partly out of disagreements between the local party and the Manchu authorities over railway control, a revolt broke out at that place on Oct. 10, 1911. Sun Yat-sen was abroad at the time, but hurried back to China. By the end of the year the revolt had spread throughout the Yangtze Valley, and on Jan. 1, 1912, a Republican government was set up at Nanking, with Sun Yat-sen as the provisional president. Negotiations followed with Yuan Shih-kai, who was at the head of affairs in Peking, and an agreement was reached which provided for the abdication of the Manchus, and the selection of Yuan as the first president. Sun resigned on Feb. 12, 1912, in order to clear the way for the unification of the country under the Republic.

Developments in succeeding years convinced Sun that the purpose of the revolution was not being carried out. He became involved in a succession of open conflicts with the administration at Peking, and headed several independent "Governments" at Canton. He

spent part of his time in Japan, working for the reorganization of the revolutionary party. During this period he met and married Sung Chung-ling, who aided him greatly in his subsequent work. In Dec., 1924, Sun went to Peking at the invitation of the military leaders then in control, in an effort to work out a plan for the unification of the government. He died in Peking Mar. 12, 1925.

Sun Yat-sen to-day is revered throughout China as the Father of the Republic. His doctrines, particularly those embodied in his book *The Three Principles of the People*, are studied and quoted as furnishing the programs which China must follow in her reconstruction. A tomb has been erected for him, just outside of Nanking, and this has become the center of pilgrimages by officials and others from all over the country.

SUPER-CHARGER, a mechanical device for forcibly feeding an INTERNAL COMBUSTION ENGINE with a greater weight of fuel than would normally be taken in at the prevailing atmospheric temperature and pressure. Three important types are now in use in aviation: the Root, the centrifugal and the vane.

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SUPERHEATED STEAM. See STEAM.

SUPERHEATERS are used in connection with BOILERS to impart additional heat, but no additional

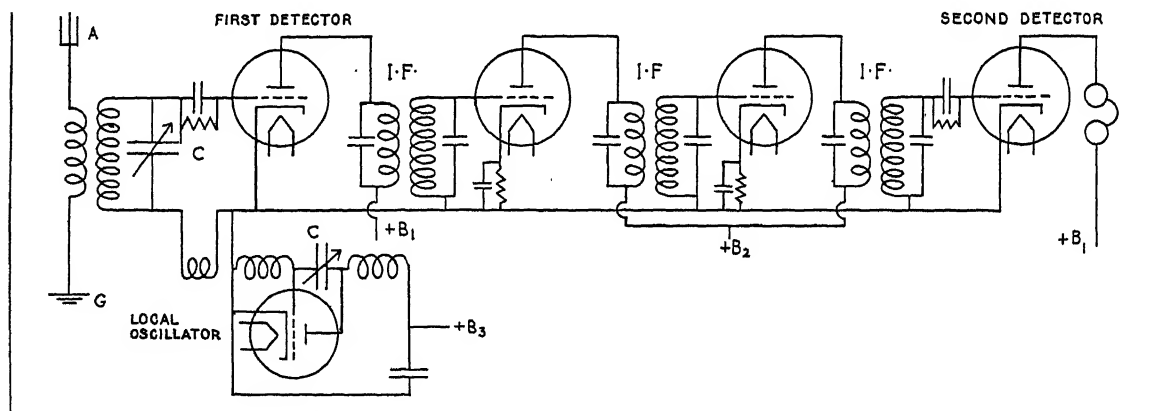
boiler tubes or above the tubes, thus receiving heat from the same flue gases as does the boiler.

When located between horizontal banks of boiler tubes they are the *interdeck* type, and those whose tubes are between the tubes of the boiler are the *intertube* type. Radiant superheaters are located on the walls of the furnace and absorb heat radiated by the fire, serving to protect the walls as well as to superheat steam. With convection superheaters the temperature of the superheated steam generally increases with the rate of coal burning, while with the radiant type the opposite is true. To obtain a nearly constant superheat at all loads a combination radiant and convection superheater is frequently installed.

In the operation of a superheater the steam collected in the dry pipe of the boiler drum passes downward to the upper manifold of the superheater, through the superheater tubes where its temperature is increased, into the lower manifold and thence to the superheated steam header serving the engine or turbine.

SUPERHETERODYNE, a type of RADIO RECEIVER consisting essentially of a FREQUENCY CHANGER, a fixed-frequency amplifier (see AMPLIFICATION) plus the customary DETECTOR and audio amplifier. The latter two items may be identical in any type of radio receiver.

The principal advantage of the superheterodyne is



SCHEMATIC WIRING DIAGRAM OF SUPERHETERODYNE RECEIVER

The frequency changer consists of a local oscillator and first detector. Tuning is accomplished by condensers marked C. I.F. indicates the transformer tuned to a fixed intermediate frequency. An audio amplifier must be added to this circuit for loudspeaker reception. Three element heater type vacuum tubes are shown here, but screen grid tubes and filament type tubes may also be used.

pressure, to STEAM after it has left the boiler. Superheated steam greatly improves the economy of STEAM ENGINES and TURBINES (see TURBINES, STEAM) and is extensively used in modern POWER PLANTS, the gain in economy varying from about five per cent in a first class engine to 50% in a poor, simple, non-condensing engine. Superheaters are classified, according to the manner in which the heat is transferred to the steam, as *convection* and *radiant* types. Convection superheaters may receive their heat independently of the boiler but are usually integrally built within the boiler setting. They may be located among the

that an amplifier can be built to operate at a single fixed RADIO FREQUENCY more efficiently and with greater selectivity than an amplifier which is tuned by the operator over a wide range of frequencies. In addition, the tuning process is simplified. Moreover, since the superheterodyne employs a radio frequency in the fixed-frequency amplifier which is lower than frequencies in the broadcast bands, it is easier to keep the amplifier stable even though its amplification be high.

The accompanying figure shows a schematic wiring diagram of the essential parts of a superheterodyne.

Many such receivers now employ one stage of tuned radio frequency between the ANTENNA and frequency changer. Also, many refinements in the way of FILTER circuits and SHIELDING of TUNED CIRCUITS are ordinarily used.

L. G. H.

SUPERINTENDENT, a chief overseer or inspector; particularly, in Protestant churches of the European continent, the chief clergyman of a district, whose duty it is to supervise the activity and behavior of the clergy and also the finances of the church. Over the superintendents of a province or of a small State is a superintendent-general, who roughly corresponds, though in an administrative sense only, to a bishop. In South Germany the clergyman corresponding to a Superintendent is a DEAN.

SUPERIOR, a lake port city in northwestern Wisconsin, the county seat of Douglas Co., situated at the western end of Lake Superior, opposite Duluth, Minn., to which it is connected by a bridge. Lake steamers and six railroads afford transportation. There is an airport. Superior is an important shipping center for iron, copper and coal and is also a grain market. Flour milling, the manufacture of furniture and shipbuilding are the chief industries. Abundant water power is furnished by the St. Louis River. The retail trade in 1929 amounted to \$18,510,533. The city is the seat of a state teachers' college. French explorers visited this site probably as early as 1661. In 1853 a group of capitalists, led by W. W. Corcoran, laid out the town. Superior was incorporated in 1889. Pop. 1920, 39,671; 1930, 36,113.

SUPERIOR, LAKE, one of the five Great Lakes in east central North America. It is situated on the boundary dividing the United States and Canada, between 40° 30' and 49° 00' N. lat., and 84° 30' and 92° 06' W. long., and bounded by the states of Minnesota, Wisconsin, Michigan and the province of Ontario. Besides being the largest of the Great Lakes, Superior is also one of the largest expanses of fresh water in the world. Its greatest length is 360 mi., breadth 160 mi. and surface area 31,820 sq. mi., of which 20,710 are within the jurisdiction of the United States. Compared with the other lakes in the group, it has a greater elevation, deeper and colder water and a shorter season for navigation. Its altitude of 602.23 ft. above sea level exceeds that of lakes Huron and Michigan by 21.29 ft.; and its maximum depth of 1,290 ft. is over 600 ft. below sea level. The mean depth is 475 ft.

The coast line of the lake measures 1,500 mi. and is indented by two large bays, Whitefish and Keweenaw. The Apostle Islands lie off the coast of Wisconsin and the beautiful Isle Royale, a popular summer resort, is situated off the coast of Ontario. From its drainage basin of 80,900 sq. mi., including 37,570 sq. mi. of United States territory, there are no large rivers emptying into the lake although there are numerous small streams, principally the St. Louis River with its mouth at Duluth.

Lake Superior empties into Lake Huron through St. Mary's River, a stream about 63 mi. long, ob-

structed by a mile-long section of steep rapids. The canals built on both the American and Canadian sides of these rapids constitute the greatest artificial waterway in the world in point of commercial traffic handled. In 1929 the cargoes passing through them aggregated 92,622,017 tons for the navigation season of eight months. The Suez Canal, next in commercial importance and navigable throughout the year, carried 33,466,014 tons.

The chief harbors on Lake Superior are Agate Bay, Minn., Ashland, Wis., Port Arthur, Ont. and Duluth, Minn. which is one of the most important ports on the Great Lakes because of its facilities and the magnitude of its commerce. The total amount of freight cleared through it in 1929 was 60,385,767 tons valued at \$485,631,945, of which 45,014,332 tons were ores and metals, 11,729,781 tons were nonmetallic minerals and 3,282,862 tons food products, chiefly wheat.

Lake Superior was discovered in 1616 by Etienne Brulé, an adventurous Frenchman seeking the source of the copper from which the Indians made their arrowheads. In 1854 the opening of the Sault Ste. Marie Canal marked the beginning of its commercial importance. The season of navigation opens about the 20th of April with the breaking up of the ice and ends near the middle of December when terrific storms and intense cold make shipping impossible.

SUPERNATURAL applies to phenomena that seem to lie beyond the recognized forces of the physical world or to transcend the ordinary workings of the mind and body. Physical miracles and supernatural powers may be thus considered. Older explanations of psychic phenomena, such as possession, inspiration, clairvoyance, mind-reading, the power to move objects at a distance, to float in air, would from the modern point of view be regarded as a belief in the supernatural. It is the purpose of psychology to account for this range of phenomena in naturalistic terms, including the effects of suggestions, hallucination, prejudice and recognized abnormal conditions.

SUPERNORMAL, a supposed power in specially endowed individuals to transcend the ordinary range of the senses; this is responsible for descriptions of supernatural phenomena. If TELEPATHY could be established it would in that sense be supernormal.

SUPER-POWER, a name given to a composite high-voltage electrical network extending over considerable geographic area into which the several power sources feed and from which power is distributed to various districts. Economies are effected in system-capacity because of the diversity in output of the various stations at different times and mainly because of the large diversity in time of peak loads in the different districts. See also POWER TRANSMISSION, ELECTRICAL.

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SUPER-REGENERATION, in radio, the supply of an excess of REGENERATION to a DETECTOR for

several cycles of an incoming signal. The average value of the signal strength shows an increase over that obtained on simple regeneration. Control of the detector tube is usually effected through ALTERNATING CURRENT of a frequency above the audible. The current may be generated by means of auxiliary circuits connected to the detector tube, or a separate tube may be used and the circuits coupled to the detector.

SUPER-SONIC WAVES, waves set up in a medium with frequencies higher than the upper limit of audibility (*see* AUDIO FREQUENCY). Such waves may be generated either by QUARTZ crystals used in vacuum tube circuits (*see* TUBES, ELECTRONIC) or by short rods of steel, cobalt or nickel.

If an alternating electrical voltage is applied to the two faces of a plate of quartz cut perpendicularly to its electric axis, alternate contractions and expansions occur. When the frequency of the electrical oscillations coincides with the natural frequency of the quartz plate, the plate is set into violent vibrations of very high frequency, thus generating super sonic waves. Vibrations in a steel, cobalt or nickel bar are set up by the magnetostrictive action of oscillating currents in a coil of wire surrounding the bar. These currents, supplied by vacuum tube oscillators (*see* OSCILLATOR, ELECTRIC), are tuned to the natural frequency of the bar. Super sonic waves, have been obtained with a frequency of the order of 500,000 vibrations per sec. and a wave-length, in water, of 0.1 in.

In practice, super sonic waves are used in submarine signals, depth sounding and in the location of icebergs or other partially submerged obstacles to navigation. Because of their extremely short wave-length, they travel in definite beams. In depth sounding, a short train of super sonic waves is sent downward from the bottom of the ship. It travels to the bottom and is reflected back to a receiving circuit. The short time interval between the transmission and reception of the signal is automatically recorded on a scale calibrated to read directly the depth of the water.

The physical intensity for even minute amplitudes in super sonic waves is very great and they have been demonstrated to have a decided germicidal action.

P. E. S.

SUPERSTITION, a belief surviving from an earlier stage of thinking and based on relations of cause and effect that are inconsistent with science. Primitive ways of thinking, childish acceptances, folklore tradition, and ignorance combine to keep superstition alive among the uninformed classes. Yet the strong emotional trend, actuated by hope or fear, maintains the appeal of all sorts of beliefs to superstitious minds, of whatever degree of general education.

Nature of Superstitious Thinking. Superstitions, as well as other forms of magical and mythical knowledge, are concerned with the quest of fate; the same trend leads to many varieties of fortune telling. Superstition arises and continues because every slight event and detail of behavior is regarded as in-

fluencing what is to come, to bring good luck or bad luck. Seeking and avoiding, hoping and fearing of this order incline to the superstitious order of thinking. Yet superstitions also arise by lack of knowledge of real causes and by a reference of events to relations personally more satisfying.

A similar order of belief was systematized from earliest days. Typical of such body of lore is *ASTROLOGY*, the earliest of the pseudo-sciences. These are based in some measure upon the same ways of regarding cause and effect. The reading of omens, whether in the skies, or in the flight of birds, or in the appearance of entrails of animals sacrificed to learn the will of the gods, likewise became a professional function of priest or wise man; yet such beliefs for the most part are carried in the medium of popular tradition.

Superstitions change at each stage of culture and develop as part of the cultural trend, reflecting the current views of religion, of the nature of the world, of the arts and occupations as practiced, of rituals, observances and ceremonies in all fields of life. There is hardly a phase of human thought or action free from the impress of superstitious thinking.

Range of Superstitions. The range of superstition and the habit of belief which it reflects will be sufficiently illustrated by selecting a few fields that are particularly attractive to the superstitious mind. There is the protection by charms, amulets and mascots to attract good luck and go unscathed through danger. The original setting of such beliefs was a world of *Magic* in which the forces that control events were regarded as friendly or hostile to human fate; it was also a world of human enemies ready to use dire forces to injure. Without such belief superstitious practices would never arise. Such was the belief in the *EVIL EYE* and in *WITCHCRAFT* of any form. Hence a bit of metal or stone, a trinket of any kind, but usually with some symbolic meaning, would be worn as a charm, or if it contained a prayer or scriptural text, would be called a talisman. The bits of mirror woven into Oriental embroideries, seemingly ornamental only, may be regarded as well as warding off evil. The custom among Greek peasants of leaving some stitches unfinished in a gown, lest, if finished, it would soon finish the life of the wearer, like the prejudice against giving a knife as a present, lest it cut friendship, show the process of superstitious thought somewhat elaborated.

Once this habit of thought prevails, it may attach itself to any of many objects for any of many reasons, and the reasons may be vague or lost in the obscurities of myth and folk-lore. Just how the horseshoe became so typical an object of superstition is not clear; whether for so long the sign of travel with its dangers and adventures, or associated with ancient myths of Pegasus or Apollo's chariot or Neptune's sea-horses is rather immaterial. Finding a horseshoe, since it is a chance, parallels other finding superstitions, such as a four-leaf clover; or just picking up pins to induce further finds. It may be that in addi-

tion the horseshoe was associated by its shape with the moon's crescent; the horseshoe had to be nailed with the prongs up to retain the good luck that might befall, as similarly the crescent moon in that position becomes a good omen. Salt as an indispensable article of food came into the magic circle; so spilling salt was unlucky, and throwing a pinch of it over the left shoulder an offset of bad luck.

Psychic Aspect of Superstition. In the folk-lore of names, numbers, images and reflections we come upon the psychic side of superstition, which derives in part from an other-world of spirits, human and super-human. In general any part of the body, such as locks of hair or clippings of fingernails, could be used to cast a spell; hence these were burnt to prevent such disaster. Or an article of clothing once worn could be used to work a spell. A glove might be buried, perhaps with appropriate incantations, with the notion that as the glove rotted so would the person who once wore it go to his end. Or substitution would do. There is preserved in a museum of such beliefs at Oxford a lemon pierced with nails, each nail representing a victim and a curse upon one of the enemies of an old Welsh woman who prepared this superstitious object.

As an image stands still nearer to the person, many primitive people object to having their pictures taken lest the representation be used for witchcraft. For a similar reason one must not step on the shadow of another. When the custom prescribes that mirrors be covered in a house in which a death has occurred, it may be traced back to a precaution to prevent the departing spirit from seeing its reflection. Breaking a mirror is bad luck for similar reasons, for it may have reflected the human visage. Among primitive people dreams are regarded as the actual adventures of the spirit that has for a time left the body. Hence one must never awaken a sleeper lest his spirit be away on a journey. Belief in the prophetic nature of dreams is similarly founded. Names are concealed lest harm be worked by their use, and magic formula are everywhere used. Numbers enter into beliefs in lucky and unlucky events; many rites must be performed three times to make them come true.

Effect of Tradition. When historical traditions, such as Christianity, met with such folk-lore products, they transformed and added to them. Thus the two most common of all superstitions relate to 13, the number seated at the Last Supper, with its special reference to 13 seated at a table, though applied to floors of buildings and dates of the month as well; and Friday, which was the day of the crucifixion. The unlucky aspect of three, which leads some persons to avoid lighting three cigarettes with one match, is similarly referred to the situation of Christ between the two thieves.

Medical Superstition. Wherever touched upon, superstition reveals about the same order of strange logic and common notions about good and bad luck. The range of medical superstitions is a large one, for the cure of ills is an ever-present desire, and disease is

a constant threat. There may arise a belief that handling toads will produce warts, or toads may be used to drive warts away, because of the similarity of the spots on the skin. Chinese doctors may use the heads, middles and roots of plants for treating diseases of the head, chest or feet; and the mandrake, by reason of its resemblance to the human form, is regarded as a particularly effective medicine. In such a practice as taking a hair of the dog that bit one to cure a dog bite, there is a trace of sympathetic magic. That unusual and horrible substances will act as powerful remedies is the basis of many old-time treatments; though when mummy powder is supposed to confer longevity, the logic is more remote.

Varieties of Superstitious Belief. If one were to collect at random common superstitions such as objections to walking under a ladder, postponing a wedding, wearing a peacock feather, leaving a house by a window, stepping on the cracks of paving stones; or precautionary measures like knocking on wood when one says he has not had a cold this winter, or saying, "*Gesundheit*," health, upon sneezing; or protective ones as carrying a rabbit's foot or an elk-tooth; or the remedial ones in which home medical practice abounds; or the fortune-telling with tea-leaves and cards; or the beliefs that go over into pseudoscience, such as horoscopes, numerology, palmistry and dream interpretation, the collection would afford a motley picture of the currents and undercurrents of superstitious belief, often half-belief or playful belief, that survive in all civilizations, in all classes of people.

The mental habits of children find many of these beliefs congenial. Wherever culture lags and education is limited, such beliefs acquire a stronger hold. The Negro has a rich vein of superstition not so much by transfer from West African tradition, though voodoo practices seem to be of this origin, as by absorption and elaboration of the superstitious currents in his habitat. In certain sections of Pennsylvania superstitions survive in connection with agricultural practices; operations relating to crops, as churning, sowing and reaping, are prescribed by a superstitious ritual. In the same regions there flourishes the belief in hexing or witchcraft, which in turn may be exercised to bring injury to live-stock or other property of an enemy.

For the most part superstitions survive in mild and innocent form as an interesting, fanciful sign language, often with the connection remote or lost. Thus an itching skin means that visitors are coming; a blister on the tongue that you have told a lie; when your ears burn that someone is speaking of you, favorably if the right ear, unfavorably if the left; that when you have cold shivers someone is walking on the spot that will be your grave. Such meanings of bodily signs arise readily in a superstitious frame of mind. In these there is no rhyme or reason, or only so much as is carried over from a habit of thought which in all serious matters we have outgrown. When we have bodily symptoms of moment, we interpret them quite differently and in scientific man-

ner, and if in doubt consult a physician, while in older days people went to fortune tellers and soothsayers.

Superstitions contribute to the story of how mankind learned to think on the road from myth to reason or from folk-lore to science from the supernatural, supported by plausible analogy, to the natural, supported by proof and experiment. J. J.

SUPER-TAX. See SURTAX.

SUPPLY AND DEMAND, the amount of a commodity or service which is offered or desired. According to Malthus, "demand may be defined to be the will combined with the power to purchase, and supply the production of commodities combined with the intention to sell them." In general, where the total supply of a commodity is capable of variation, supply increases and demand decreases with every increase in price. J. S. Mills, in his *Principles of Political Economy*, says, "the quantity demanded and the quantity supplied, will be made equal. If unequal at any moment, competition will equalize them." This theory of supply and demand, however, is reversed in cases of glut, scarcity or monopoly.

Demand depends on the PRICE of goods and on the tastes, needs and habits of people. There are certain laws by which it may be estimated. Unsatisfied demand tends to increase to the limit of desire and of the capacity to pay the necessary price; demand unsatisfied through want of capacity ordinarily finds alternative satisfaction in a substitute at a lower price; demand tends to vanish after every completed exchange and through successive extinctions the probability of its reappearance decreases; after exhaustion, demand tends to recur after an interval of time; after extinction in one group of individuals demand may be revived by falling prices in another group.

Supply is conditioned upon such things as cost of production, price changes and, in foods, size of crops. Unless the supply of commodities is regulated, an increase in supply has a tendency to depress prices and vice versa. Conversely, an increase in price tends sooner or later to increase supply, except in cases where the aggregate supply is invariable. In regard to capital and labor, however, it is difficult to ascertain the effect of price changes on supply. For instance, when the rate of interest is increased many people may be led to save and invest money they would otherwise spend, but other people may be influenced to invest less money since the return on a lesser sum will provide an income adequate to their needs.

An increase in the supply of one commodity will tend to increase the demand for other commodities used jointly with it. Thus, an increase in the supply of coffee often stimulates a demand for sugar; or an increase in capital brings a demand for labor. On the other hand, where commodities can replace each other, an increase in the supply of one tends to lower demand for the others. C. F. We.

SUPPLY AND TRANSPORT, MILITARY.
See SERVICES OF SUPPLY.

SUPRARENINE. See ADRENALIN.

SUPREME COUNCIL, a body composed of two representatives from each of the principal allied and associated powers which assumed control of the Peace Conference of 1919. The main decisions, however, were made by an inner Council of Four, composed of the prime ministers of Great Britain, France and Italy, and the President of the United States. From Jan. 1920, when the TREATY OF VERSAILLES went into effect, until Dec., 1923, the allied prime ministers met from time to time as the Supreme Council to decide various troublesome questions still disturbing postwar Europe.

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SUPREME COURT OF THE UNITED STATES, provided for in the Constitution, was set up under the Judiciary Act of 1789. The Court to-day is made up of a Chief Justice (salary \$22,500) and eight Associate Justices (salary \$20,000) appointed by the President with the consent of the Senate, holding office for life or during good behavior. The Supreme Court possesses original jurisdiction "in cases affecting ambassadors, other public ministers and consuls, and those in which a State shall be a party." (Art. III, sec. 2.) In all other cases, it possesses appellate jurisdiction, except where Congress has otherwise provided. Ten Circuit Courts of Appeals were established in 1891 to relieve the Court of undue pressure of business. To each of these, a Justice of the Supreme Court is assigned, the two smaller circuits being grouped as one. The organization, jurisdiction and functions of the Supreme Court are, save for the few matters covered by the Constitution, completely subject to Congressional control. It cannot dismiss sitting members nor reduce their pay. Chief Justice Marshall, however, asserted the Court has the power to declare any acts of Congress unconstitutional, and long acquiescence in the procedure has established this as one of the fundamental constitutional principles of the United States. S. C. W.

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SURABAYA, a city of Java, capital of the residency of Surabaya and principal port and naval base of the Dutch East Indies. It is situated on the north coast of the island, at the mouth of the Surabaya River. The city contains a notable government house, a mint and innumerable warehouses and other commercial establishments, for next to Batavia it is the most important commercial city of Dutch India. It is the export point for Java's principal product, sugar, and an important trading center for the commodities grown in the region. Pop. 1927, 250,000.

SURAT, a city in northern Bombay, British India, and capital of the district of Surat, situated on the River Tapi, 15 mi. from its mouth, 168 mi. north of Bombay. Under the Mogul empire it was the chief commercial city of India. During the 17th and 18th centuries it was the trade center of India, but

with the transference of trade to Bombay, the new capital of the possessions of the East India Company, Surat declined rapidly. The city's former manufacturing importance is symbolized in the use of the name Surat, like that of its neighbor, Broach, for a certain quality of Indian raw cotton. Surat is now an industrial center with cotton, silk, paper and rice-cleaning mills, and ice and soap works. Pop. 1921, 117,434.

SURD, an incommensurable root of a commensurable number. For example, $\sqrt{2}$, $\sqrt[3]{5}$, each of which is incommensurable with unity, and cannot be expressed as a fraction with rational numerator and denominator. The term is loosely used; but in general, numbers like $\sqrt{2} + \sqrt{3}$ are not called surds although they are irrational. Similarly $\sqrt{\pi}$ is not a surd, but a transcendental number.

SURETY, in law one who at the request of another makes himself responsible for some performance or payment to a third person. The one owing the payment or performance for whom the surety acts responsible is called the principal. Under the Statute of Frauds a surety cannot be held for the debt or default of performance of another without a note or memorandum in writing signed by the surety. The surety is released if the creditor extends the time of payment or performance by binding agreement with the principal without knowledge or consent of the surety.

SURF, the name given to the phenomenon observed in the ocean waves on shallow beaches. The waves running up shoreward are here so retarded from below by friction against the sand or rocks, that their crest curves over forward and finally topples over, forming the well-known "breakers."

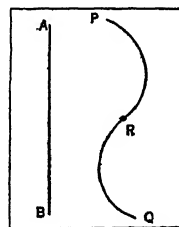
SURFACE, the outside of anything; in geometry, that which is imagined as having length and breadth, but no thickness, like a shadow. A plane surface is usually defined as a surface in which a straight line joining any two points in that surface will lie wholly within it. A curved surface is such that it may be so cut by a plane through any of its points as to have its line of section a curve. A developable surface is one which may, like a cylinder or a cone, be unrolled in a plane without buckling or breaking.

Speaking more scientifically, let the points of three-dimensional space be referred to a rectangular set of axes, so that each point has the coordinates, x, y, z . Consider any equation $F(x, y, z) = 0$. The totality of points whose coordinates satisfy such an equation are said to constitute a surface. The above equation is called the equation of the surface.

A surface may be defined by a geometric condition, and its equation determined from the condition. For instance, consider a sphere of radius a , with center at the origin of coordinates. Let P , of coordinates x, y, z , be any point of the sphere. The square of the distance from P to the origin is known from ANALYTIC GEOMETRY to be $x^2 + y^2 + z^2$. Then the equation of the sphere is $x^2 + y^2 + z^2 = a^2$. Again consider a

cylindric surface whose axis is the z axis, and whose radius is a . The distance of a point on the surface from the z axis is $\sqrt{x^2 + y^2}$. Then the equation of the surface is $x^2 + y^2 = a^2$.

The theory of surfaces is, in many respects, analogous to the theory of CURVES. One sharp difference presents itself early. A tangent line to a curve will, as a rule, graze the curve, without cutting across the curve in the neighborhood of the point of tangency. Only in the case of a point of inflection will the tangent cut across the curve at the point of tangency. On the other hand, it is just as common for a tangent plane to a surface to cut through the surface at the point of tangency as not. For instance, let the curve PRQ be rotated about the line AB , generating a surface. The surface may be considered as divided into two parts, which are separated by the circle generated by R , the point at which the curve changes from concavity towards AB to convexity towards AB . One sees easily that, at a point in the upper part of the surface, the tangent plane grazes the surface without cutting through it, whereas a tangent plane in the lower part of the surface cuts through the surface. The latter fact is seen from the circumstance that a tangent plane at a point on the curve between R and Q is perpendicular to the plane containing AB and the curve. Points in the upper part of the surface would be called elliptic points, those in the lower part hyperbolic points. Points on the circle generated by R , which circle separates the elliptic points from the hyperbolic points, are called parabolic points.



Given two points on a surface, there is, among all the curves lying on the surface, and joining the two points, one whose length is a minimum. Such a curve is called a geodesic. On a plane, the geodesics are straight lines; on a sphere, they are great circles, that is, intersections of the sphere with planes passing through the center. Through every point of a surface there pass an infinite number of geodesics, one in each direction.

J. F. RI.

SURFACE IRRIGATION. See IRRIGATION.

SURFACE PHENOMENA. Interior particles of a substance are equally surrounded by particles of their kind. Surface particles are, on at least one side, in contact with something else, i.e., another "phase." Due to the attraction of this different phase, the surface particles are unbalanced as a result, often exhibiting marked residual electronic attractions, molecular orientations, etc. These residual attractions are powerful and often speedily satisfy themselves. A surface film adsorbed from the atmosphere prevents mercury from amalgamating freshly-broken cast iron; but iron broken under mercury is amalgamated at the fresh surfaces. The orientation of molecules at an interface may determine the behavior of the surface. Thus, if a drop of molten fatty acid is floated on hot water and allowed to chill there, after careful drying, the lower half may be wet by water, while

SURFACE SPECIFICITY—SURFACE TREATMENT

the upper half *sheds* water. Surfaces are therefore highly "specific." Catalyses of all kinds, including those essential to life, take place under the conditions of SURFACE SPECIFICITY. See also ADSORPTION.

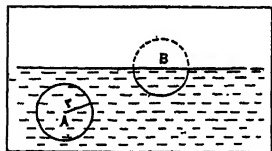
J. A.

SURFACE SPECIFICITY. When atoms combine to form molecules, their attractive forces remain partially unsatisfied. These residual valencies or free fields of force, as they are called, enable most molecules to cling together, and are responsible for the coherence and strength of solids. Considering any very small area of a solid, obviously the free fields of force there will make a highly specific, or characteristic mosaic of positive and negative regions, the precise nature of the mosaic depending on exactly what molecules are in the surface and which way they are turned or twisted. Introduction of even one new molecule into such a limited area (or a change in the neighboring phase) may produce a shift in the electronic forces at the surface and modify its specific properties. With "promoters" in *catalysis*, with *enzymes* which Emil Fischer said were adjusted to their *substrates* like lock and key, and probably also with *immunity* and similar reactions, we are dealing with the far-reaching effects of surface specificity.

J. A.

SURFACE TENSION. If the surface of a liquid is examined, it is found not to be perfectly level but curved at the edges. If a clean sewing needle is placed on the surface, it floats, close examination showing that the surface is covered with a relatively tough skin. If a vertical tube of small bore is placed with one end in a liquid, the liquid will rise in the tube some distance above the level of the surface in the containing vessel. The smaller the diameter of the tube the greater the rise. A drop of mercury on a horizontal plate will be found to be nearly spherical. A drop of oil on clean water spreads almost instantly, to form a very thin film. These are typical surface tension effects.

The simplest experiments prove beyond doubt that surface tension is due to intermolecular forces. However, while the force between two MOLECULES in intimate contact is enormous, the forces become inappreciable when the molecules are small fractions of a millimeter apart.



Starting with the assumption of the existence of intermolecular forces and rapid diminution of these forces with distance, Laplace first developed, about 1807, the theory of surface tension and capillary action.

Consider the forces acting on a given molecule, *A*, in a liquid (Fig. 1), and assume that all the molecules within a sphere of radius, *r*, and described about *A* are attracting it. It is obvious that *A* will not be conscious of any force, because the forces of attraction are equal in all directions. Taking a molecule, *B*, in the surface of the liquid, there is an unbalanced

force of molecular attraction directed toward the inside of the liquid. This force continually urges *B* into the interior of the liquid. But all the other molecules in the horizontal layer with *B* are urged inward with the same force, and all the molecules in the other layers within a distance, *r*, of the surface are urged inward with other forces. The net result of these unbalanced molecular forces acting on the molecules near the surface is to exert a pressure on the interior of a liquid mass similar to that which would be caused by an elastic skin. This accounts for the spherical form of the raindrop, the soap bubble and the globule of oil floating beneath the surface of a liquid of the same density.

Consider a strip of this elastic skin one centimeter wide. The force in dynes required to tear this ribbon

↑ *F*

is a measure of surface tension. In practice, this tension may be determined by immersing a wire, *ab*, (Fig. 2) in the liquid and pulling it up by a force, *F*. Experiment shows that $F = 2Tab$, when *ab* is the length of the wire in centimeters and *T*, the surface tension. The factor, 2, comes in because there are two films, as shown in Fig. 2a.

The relation between surface tension and capillarity may be found in Fig. 3. The mutual attraction between the molecules of glass and water causes the water to creep up the glass tube. This effect is due to surface tension; by measuring the rise, the surface tension can be calculated. If *h* is the height, the weight of the liquid which is supported by the surface tension is $\pi r^2 h d g$, where *r* is the radius of the tube, *d* the density of the liquid and *g* the constant of gravity. The length of the surface under tension at the junction with the glass will be $2\pi r$, and, since the film is tangent to the glass at this point, the force exerted on the glass by the liquid is $2\pi r T$. Hence, $\pi r^2 h d g = 2\pi r T$, which gives $T = \frac{1}{2} h r d g$. The value for water at ordinary room temperature is 75 dynes. At higher temperatures the value of *T* is lower. E. J. M.

FIG. 3

SURFACE TREATMENT, a method of restoring old roads or pavements and preserving supporting road "crusts." It is used as an improvement of low type roads such as macadam or gravel to reduce maintenance cost under increased traffic density. It involves: 1. Reshaping the road crown and profile;

2. Priming with a light bituminous road oil, cut back asphalt, emulsion or tar; and 3. Constructing a new bituminous coating. This may be a "seal coat" of heavier bitumen covered with $\frac{1}{2}$ inch chips or gravel; or a double seal coat of this type, or a "retread surfacing" in which graded stone of a maximum size of one inch or less—after being coated with bitumen either by spray from an asphalt distributor truck or by being dipped in asphalt—is mixed and spread to a true surface by blade grader or road maintainer. *See ROAD MACHINERY.* The "retread" is generally given a seal coat. For this work special tar, a cut-back asphalt or an emulsion is used. *See also BITUMINOUS MATERIALS.*

Such treatments may provide good surfaces for traffic of as much as 2,000 light vehicles a day at a moderate annual repair expense. W. W. H.

SURF BIRD (*Aphriza virgata*), a small plover-like shore bird, closely allied to the turnstones, so called from its habit of seeking its food of crustaceans and various other aquatic animals among the retreating waves, often with the spray dashing over it. It is about 10 in. long, slaty gray above variously marked with white and reddish, and white below. Although nowhere common, it ranges along the Pacific coast from Alaska to Chile, breeding in the north.

SURF-FISH (*Embiotocidae*), a large family of fishes, resembling the perches, found in shallow bays and inlets along the Pacific coast of the United States and Japan. A few occur in fresh water streams. Their oval bodies, often striped and marked with bright colors are from 6 to 8 in. long. All surf-fish are viviparous, the females carrying the young in a sac-like enlargement of the oviduct. Surf-fish have little food of commercial value, the flesh being flavorless and bony. Anglers, however, find catching them on a hook good sport. Among the best known of these fish is the wall-eyed surf-fish, or white perch (*Hyperprosopon argenteus*), inhabiting sandy shores and the common surf-fish or black perch (*Embiotoca jacksoni*) found as far north as British Columbia.

SURGEON GENERAL, a military medical officer usually having the rank of a major general in the army and rear admiral in the navy. The surgeon general of the army heads the medical department and acts as medical advisor to the War Department. The surgeon general of the navy heads the Bureau of Medicine and Surgery.

SURGEON GENERAL, ARMY. *See ARMY, U.S., MEDICAL SERVICE.*

SURGERY, the science of treating injuries or diseases by manual operations. The conditions in which treatment by surgery is indicated are injuries of all parts of the body; local inflammations, especially those in which pus has accumulated; the removal of tumors; and the alteration, repair or removal of structures that have been damaged by disease so as to render them incapable of carrying on their normal function. It is in the last field that surgery has become especially valuable.

Long ago, surgery was confined for the most part

to the treatment of external wounds and the drainage of abscesses formed immediately beneath the surface of the skin. Occasionally such operations as removal of a stone from the bladder were performed. The procedure known as blood-letting was also prevalent, but otherwise the work of the surgeon, who was also the barber, was mainly the treatment of wounds.

Two discoveries contributed markedly to the development of surgery; first, the discovery of ANESTHESIA that occurred about one hundred years ago; and second, the demonstration of the principles of antiseptics by Lister in 1870. Since Lister's day this has been supplanted by asepsis. By means of heat, gloves, instruments and everything that comes in contact with the operative wound are rendered free from germs.

The first step in the surgical treatment of injuries is the checking of bleeding. This may be done in minor injuries merely by pressure upon the bleeding points. If a large vessel is cut, a ligature is put around it and tied.

The next step is the sterilization of the surrounding skin with some antiseptic solution, such as tincture of iodine (*see IODINE*) or MERCUROCHROME. All visible dirt is removed with sterile instruments and mildly antiseptic solutions are applied to exposed tissue. After the wound is cleansed, the edges of the skin are brought together by stitches. Then a dressing of sterile gauze is applied.

If, on the following day, redness, swelling and pain develop in the wound, it indicates that infection has occurred. In such instances, the stitches must be removed and the wound opened to allow the pus to drain out.

In cases where wounds are deep and have been produced by some dirty instrument, injection of tetanus antitoxin should be given to prevent TETANUS or lockjaw.

When bones are broken or crushed, the first step in the surgical treatment consists in the exact apposition of the ends of the bones, and maintaining the position by means of a cast, splints or other mechanical device. This procedure is known as setting the fracture (*see FRACTURES*). The setting of the break should be done when possible with the X-ray as a guide. An anesthetic is usually required. In some instances it may be necessary to cut down to the bone in order to set the fracture, and occasionally it may be necessary to hold the parts together by wiring or the use of metal plates.

Dislocations of joints are treated by returning the bones to their normal positions and holding them in place by casts or splints.

The chief disorders than can be treated by surgery are as follows:

Tumors of the brain are sometimes removable. Cancer of the mouth and lips may be treated surgically. Enlarged tonsils and adenoids are cut out. When the thyroid gland becomes enlarged or when the secretion from it is increased, part of the gland may be removed. Infections of the lymph glands in

the neck, with the formation of pus, may be drained by cutting.

Infection, with the formation of purulent fluid, in the chest cavity, known as Empyema, is treated by surgical drainage. Tumors, and abscesses in the female breast require surgical treatment.

Abdominal affections, especially, require surgery. The most frequent abdominal operations performed are probably removal of the appendix for septic inflammation and removal or drainage of the gall-bladder because of infection or the presence of stones.

Surgical operations are essential when there is obstruction of the passage through the bowels or perforation of the stomach or bowel. Inflammation of the pancreas requires immediate surgical intervention.

Stones in the kidney, bladder, or ureters are removed by operations, as well as abscesses and tumors in the abdomen. Hernia or rupture in which some of the abdominal contents bulge through the abdominal wall, can be treated only by means of surgery.

Enlargement of the prostate gland, as a result of inflammation or formation of tumors, or of advancing age is a disorder for the relief of which modern surgery has accomplished much.

A special branch of surgery known as ORTHOPEDIC SURGERY has for its purpose the correction of bony deformities in children and adults.

In many disorders for which medical treatment offers little or no relief, modern surgery produces cure or such marked improvement that it is recognized as the only effectual procedure. W.I.F.

SURPLICE, a white, shirt-like garment worn by clergymen primarily in the choir, in the 14th and 15th centuries. Long and voluminous, it was later abbreviated. The choristers wear a similar vestment, commonly called *cotta*, which, like the surplice, is an adaptation of the ALB. In the less ritualistic Anglican churches the surplice with the STOLE is worn at all services. In the Catholic Church it is ornamented with lace.

SURREALISM, a movement in art inaugurated in France in the second decade of the 20th century by one of the founders of DADAISM, André Bréton. In the manifesto of the movement he described Surrealism as "dictated by thought, in absence of all control exercised by reason, and exclusive of all moral or esthetic preoccupations." An effort was made to portray the workings of the subconscious mind, but the movement became, in the words of a critic, one whose device might well have been "Blood, Eroticism, Death." Among the artists whose names are associated with the movement are Clair, Picabia, Man Ray, Dali, Masson and Miro. The movement also had its counterpart in the work of a Paris literary group during 1924-30.

BIBLIOGRAPHY.—Hiler Harzberg in *The Art Digest*, May, 1927; Pierre Courthion in *Cahiers de Belgique*, April-May, 1931.

SURREY, HENRY HOWARD, EARL OF (c. 1517-47), English poet and soldier, was born about 1517, the son of Lord Thomas Howard, and

the grandson of Thomas Howard, 1st Earl of Surrey. He was unusually well educated, and from 1530-32 lived at Windsor with the young Duke of Richmond, the natural son of King Henry VIII. He accompanied the king to France in 1532, and remained about a year at the French court. He was made a Knight of the Garter in 1541, and later became cup-bearer to the king. In 1545 he acted for several months as Governor of Boulogne, France. In 1546 he and his father, now the 3rd Duke of Norfolk, were falsely accused of treason by political enemies. Surrey, who had only a courtesy title, was tried, not before a jury of his peers, but before one specially picked for the occasion. Pronounced guilty, he was beheaded in London, Jan. 19, 1547. Surrey's first verses were written in 1537 while he was in prison, and indeed he was a poet only during the intervals of his exciting life at court and on the battlefield. His poems, called "Songs and Sonnetes," were first published, together with lyrics by SIR THOMAS WYATT, in *Tottel's Miscellany*, 1557. His name and Wyatt's have since then always been closely associated, and the two poets are generally credited with having introduced the SONNET into English literature. Surrey's translation of Books 2 and 4 of Vergil's AENEID is also regarded as the first example in English of BLANK VERSE. See also ENGLISH LITERATURE.

BIBLIOGRAPHY.—W. J. Courthope, *A History of English Poetry*, 1895-1910.

SURTAX, a tax levied by, or accorded to, a subsidiary government on the same tax subject or base as is used for a tax by a superior government. Thus a city at the port of entry may levy on goods imported a surtax on top of the CUSTOMS DUTIES levied by the central government.

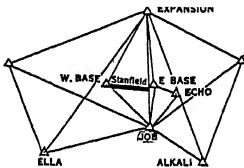
But the far more common use today is to designate those tax rates, usually in an INCOME TAX, which are imposed over and above the normal or basic rate, for the purpose of making the rich people pay proportionately more than the poorer people. In England these are called super-taxes. In the United States Federal income tax the normal rate applies to all incomes. But beginning with incomes over \$10,000 a series of additional rates called surtaxes begin which increase steadily up to \$100,000. C. C. P.

SURTEES, ROBERT (1779-1834), English antiquary and topographical historian, born in 1779. He was educated at Christ Church, Oxford and also studied law. In 1802 he settled on his inherited estate at Mainsforth and thereafter devoted himself to the collection and study of local antiquarian material and to the writing of his *History of Durham*. His ballads were so decidedly in the "old manner" that Scott included one of them in his *Minstrelsy of the Scottish Border*, believing it to be ancient. He died at Mainsforth, Feb. 11, 1834. Almost immediately after his death (May, 1834) the Surtees Society was formed, being designed to perpetuate the excellent work in local history pursued by him and dedicated to the collection and publication of documents relat-

ing to the history and antiquities of Northern England.

SURVEYING, the art of measuring distances and directions, and locating points on the surface of the earth for such purposes as fixing boundaries, making maps (*see* MAPS AND MAPPING), or laying out engineering structures. The *geodetic* survey has for its object: 1. The determination of the size and form of the earth's surface, and 2. The establishment of "control" points for topographic and other surveys. The chief method used is that of triangulation, the distances being calculated from a BASE-LINE. The *cadastral* survey is made to determine the positions of boundaries, state or private, and enclosed areas. The *topographic* survey (*see* TOPOGRAPHY) depicts the ground as to natural and artificial features and also shows the relief, or third dimension. The *hydrographic* survey (*see* HYDROGRAPHIC SURVEYING) is for the purpose of locating water surfaces or determining depths, for harbor improvements or navigational purposes. The *mine* survey is made chiefly for the purpose of carrying the direction and location of the meridian underground (*see* SHAFT PLUMBING) so that boundaries can be fixed, or for such work as locating track, giving proper drainage, or keeping account of quantities. The preliminary *railroad* or *highway* survey is for the purpose of finding the most favorable location for the line and fixing this on the ground in the form of straight lines and curves. It involves the location of the line, or the alignment, the profile of center line, cross sections with setting of slope stakes, locating contours by hand level for adjusting the location to local conditions, and the fixing of grades. The *city* survey includes the general survey to fix reference points by plane coordinates, precise, or "first-order," leveling to establish BENCH MARKS, the fixing of lines and grades of streets, curb lines, water pipes, sewers, and conduits.

The general methods recognized are: 1. Triangula-



COURTESY U. S. COAST AND GEODETIC SURVEY
SURVEYING BASE NET

tion for establishing positions of controlling points (*see* figure); 2. Horizontal location with transit and steel tape combined with direct levels; 3. Stadia method (*see* TACHEOMETRY); 4. Plane-table method, all points being located by use of the ALIDADE and stadia distances; 5. Photographic method, by pictures taken either from ground stations or from the air. *See* SURVEYING, AERIAL; *also* PHOTOGRAPHIC SURVEYING.

G. L. H.

BIBLIOGRAPHY.—Breed and Hosmer, *Principles and Practice of Surveying*, 1906.

SURVEYING, AERIAL. Photographs taken from airplanes for mapping (*see* MAPS AND MAPPING), are usually vertical, but sometimes oblique. The vertical photograph gives a picture which is, roughly speaking, a map of the ground beneath, but it lacks exactness in that it may have errors of scale owing to variations in the height of the airplane, and errors of distortion caused by tilt of the optical axis of the CAMERA, and certainly will contain errors of displacement of all points that are not in the horizontal plane assumed as the "ground plane." These errors, however, can be eliminated and a correct map obtained. The displacements of points from these three causes take place nearly along lines radiating from the center of the pictures. The print therefore gives true directions of points from this center; this forms the basis of accurate map construction from photographs. Maps made by fitting together portions of vertical photographs, but not corrected for errors, are called "mosaics." Maps made on transparent paper or on drawing paper from data furnished by photographs, and from which the errors have been eliminated, are sometimes called "line-maps."

The effect of tilt is: 1. To displace from the center of the picture the image of an object that is vertically beneath the camera, and 2. To expand the scale on one side of the print and to contract it on the other side. The tilt does not affect seriously the directions of points as measured from the center of the print provided the angle of tilt is, say, not more than one degree. If the tilt is large, the only way it can be corrected is to reproject the picture photographically so as to obtain a negative corresponding to the true horizontal plane; in the same process the negative can be brought to the correct scale. Displacement due to elevations of points in the photograph can be eliminated from the final map by the radial method of plotting the points, or by use of a stereoscope. *See also* PHOTOGRAPHIC SURVEYING.

G. L. H.

SUSARION (6th century B.C.), Greek poet, was born at Megara, in the 6th century B.C. He is called the originator of Greek comedy. His native town was noted for its gayety and jokes which were gradually incorporated into little farces and popular diversions until an established art form emerged, known later as the classic Attic Comedy. Going to Icaria, a community devoted to the worship of Dionysus, Susarion brought his new entertainment with him though nothing of its nature is known as, indeed, little is known of the man himself.

SUSCEPTIBILITY, MAGNETIC. *See* MAGNETIC INDUCTION.

SUSPENSION, in music, the retention of one or more tones which are harmonically foreign to the chord into which they resolve. The suspended tones are said to be prepared by appearing as natural elements of the previous chord, suspended while they sound against the succeeding harmony, and resolved when they pass into that succeeding harmony. Suspension is exceedingly fruitful in COUNTERPOINT, yielding a dissonant quality without involving new

harmonic features, emphasizing the contrast between two harmonies, and at the same time binding these harmonies together. The most common suspensions are of the fourth and ninth, reckoning these intervals from the Root. The following diagram illustrates the law of suspension:



SUSPENSION BRIDGES suspend the traffic-way from steel wire or eyebars cables that hang in a curve, over a ravine or river, from two towers, one on each bank. The portions of the cables behind the towers, called "backstays," may carry the load of that section of the deck; when these backstays are not loaded, they run in an approximately straight line to a masonry anchorage. See also **BRIDGES**.

BIBLIOGRAPHY.—M. Merriman, *American Civil Engineers' Pocketbook*, 1930.

SUSQUEHANNA, the name given to the CONESROGA tribe by the Powhatan Indians and adopted by the English of Virginia and Maryland. The Swedish and Dutch called them the Minqua. They were an important Iroquoian tribe living on the Susquehanna River and its branches. Of excellent physique and warlike in nature they were almost constantly fighting with the Iroquois and whites. They were completely exterminated by 1764.

SUSQUEHANNA RIVER, the principal river of Pennsylvania, formed by the union of its north and west branches at Sunbury, Pa. The north branch rises in the Allegheny plateau in Ostego Co., N.Y., flows generally southwest into Pennsylvania where its direction changes to southeast and again to southwest before it joins the west branch. Its lower course lies mostly in limestone valleys but in several places it breaks through from valley to valley, forming water gaps. The west branch heads in Cambria Co., Pennsylvania, and pursues a crooked course eastward to meet the north fork, cutting several water gaps through opposing ridges on its way.

From Sunbury to Harrisburg the main stem of the Susquehanna flows nearly south across mountain ridges and valleys and cuts five fine water gaps. From Harrisburg the river flows southeast through a rolling, highly cultivated country to the head of Chesapeake Bay. Its length, following up the north branch, is 422 mi. in which there is a fall of 1,193 ft. The west branch is 160 mi. long and has a fall of 688 ft. Throughout almost its entire course the river is shallow, swift and unnavigable. The entire system drains an area estimated at 27,655 sq. mi., three-fourths of which is in Pennsylvania. This basin comprises a thickly populated, industrial and mining region, including the anthracite districts of the Appalachian Mountains. The cities of Binghamton and

Oswego, N.Y. and Pittston, Wilkes-Barre and Harrisburg, Pa., are situated on the Susquehanna.

SUTHERLAND FALLS, the highest waterfall in New Zealand, 1,900 ft. in height, it lies about 13 mi. from the coast of South Island near Milford Sound. The falls are in the heart of mountain, lake and forest

country. Long, high and narrow, it drops almost perpendicularly down a cliff, striking the rocky precipice twice in its descent to form three leaps. Donald Sutherland, a gold prospector, discovered it in 1880.

SUTTEE, the burning of a widow on her husband's funeral pyre. The practice appears to have existed in India from very early days. Certainly, although its precise antiquity is disputed, it was prevalent there during the Middle Ages and continued well into the 19th century. Prohibited in British territory in 1829, suttee was practised among Brahman families of high rank outside British jurisdiction many years after that. It is now virtually obsolete. Suttee was never the custom among all the Indian peoples or faiths. By Buddhism, for instance, it seems to have been generally discouraged, and it was forbidden among the Sikhs who made up the major population of the Punjab. A similar custom existed in islands of the South Pacific and elsewhere.

SUWANEE RIVER, a river of Georgia and Florida, rising in the Okfeenokee swamp in southeastern Georgia. It follows a curving course south through level country into Florida and empties into the Gulf of Mexico through Suwanee Bay, 12 mi. northwest of Cedar Keys. Including its windings the river is 240 mi. long. The Santa Fe River of Florida joins it from the east. The Suwanee drains a region important in the production of turpentine and rosin. Its name is widely known through the song, *Old Folks at Home*.

SUZZALLO, HENRY (1875-), American educator, was born at San Jose, Cal., Aug. 22, 1875. He graduated from Stanford University in 1899 and from Columbia University in 1902 (A.M.), taking his Ph.D. at the latter institution in 1905. He was assistant, instructor and assistant professor of education at Stanford 1902-07, also fellow and lecturer in education 1903-05 at Columbia. In 1907 he went to Columbia University as adjunct professor of elementary education, becoming professor of philosophy of education in 1909. He was called to the University of Washington in 1915 as president and served in this office until 1926. In 1927 he became a specialist in higher education for the Carnegie Foundation for the Advancement of Teaching, also serving as visiting Carnegie professor of international relations in European universities

1927-28, and as visiting professor at Columbia University 1929-31 and Johns Hopkins University 1930-31. He served as vice-chairman and chairman of the Carnegie Foundation Board from 1925-27 and was elected president in 1930. He has served on many national and international educational, political and economic committees. In 1929 he was appointed director of the President's National Advisory Committee on Education. He was editor-in-chief of *The National Encyclopedia*, 1932.

SVALBARD. See SPITZBERGEN.

SVERDLOVSK, formerly Ekaterinburg, administrative, economic, and railway center of the Ural Region of the R.S.F.S.R., on the border between European and Asiatic Russia. This well-built town lies on the Isety River, among the eastern foothills of the Ural Mountains, in the heart of a district abounding in gold, platinum, gems, copper, iron and coal. Sverdlovsk's founding dates from 1721; soon afterward it became the seat of the government mint and engineering works, and of imperial jewel-cutting. The town is celebrated to-day for its precious-stone cutting and polishing industries. Here Nicholas II and members of his family were executed after the Revolution. The bazaar and cathedral are of interest, and metallurgical schools rank high. Pop. 1931, 234,000.

SVISHTOV, or **SISTOVA**, a Danubian town of Bulgaria, seat of the district of Svishtov. It is the trading center for the wheat and maize growing in the district. Wine in considerable quantities is exported from this town. In 1791 Svishtov attracted attention as the place where an important treaty was signed between Austria and Turkey, defining the boundaries between these two countries. Pop. 1931, 12,647.

SWABIA. The Duchy of Swabia, extending from the River Lech to the Vosges Mts. was erected from the old Carolingian region of Alamannia by Count Burkhard of Raetia, to whom Henry the Fowler granted the title of Duke of Swabia in 919. Burkhard's line became extinct and the Duchy was granted by Otto the Great to his son Ludolph; but on the latter's revolt the Duchy was withdrawn and for the next century was granted to various families. The Duchy again came into the hands of the Emperor in 1077 when its Duke, Rudolph of Rheinfelden, revolted against Henry IV and was deposed. Henry granted Swabia to Count Frederick of Hohenstaufen, grandfather of the Emperor Frederick Barbarossa, and until the extinction of the Hohenstaufen line in 1268 Swabia furnished one of the chief focii of power for that great family. With the extinction of the Hohenstaufens, Swabia as a political entity gradually disappeared, being absorbed piece by piece into Württemberg, Baden, Hohenzollern and France.

SWABIAN LEAGUE. Several unrelated federations bear this name. In 1376 14 Swabian cities organized a federation to protect their commercial interests against the depredations of feudal lords, and burdensome taxes levied by Charles IV. The league grew rapidly, maintaining a large armed force. Op-

posing leagues were formed by the nobles, and open war broke out in 1387. Successful at first, the civic army was defeated at Döffingen in 1388, and both sides agreed to dissolve their leagues. Another Swabian League was formed in 1488 to prevent anarchy in the declining empire. Princes, knights and cities joined, and the Emperor Frederick III approved the league. It restored order in Swabia, compelled the Duke of Bavaria to give up Regensburg which he had seized illegally, and expelled the cruel and incompetent Duke Ulrich from Württemberg. It aided the Habsburg in suppressing the Knights' War in 1522, as well as the Peasant Revolt in 1525. Periodically renewed, the league broke up in 1534, due to internal dissensions in Germany brought about by the Reformation.

SWAGING MACHINES, devices in which metals are placed on a die of the shape desired and shaped by repeated blows. Swaging is usually done cold and on small diameters, as in jewelry and optical goods, but it may be done in fairly large sizes. The process is also called "swedging."

SWAHILI, a language of the BANTU group spoken in and near Zanzibar. Some old poems written in Arabic script show that it has changed little in recent centuries, and its vocabulary has borrowed heavily from Arabic. Caravans of Swahili carriers have made it a LINGUA FRANCA in the Belgian Congo.

BIBLIOGRAPHY.—A. C. Madan, *Handbook of the Swahili Language*, 1894; A. Seidel, *Swahili Konversations-Grammatik*, 1900; C. Sacleux, *Grammaire swahilie*, 1909, and *Grammaire des dialectes swahilis*, 1909.

SWALLOW, a small bird of the family *Hirundinidae*. They inhabit, at least in summer, every known land outside the polar regions. This is possible because their food consists almost wholly of flying insects. Swallows are adapted to life on the wing by the shape of their small, trim bodies, the relatively great length of the wings and the large mouths. The flight and nimbleness of these birds have excited universal admiration for endurance and grace. Although divided technically into several genera and species, these birds are quite similar in their blue-black or dark-brown plumage, their twittering cries, and general habits. Annual migrations are necessary for those venturing into high latitudes because the winter destroys their insect food. In the autumn the barn-swallows, rough-winged, cliff, bank and tree-swallows, and similar species in America and in other countries, gather into enormous migratory flocks which move slowly southward. Previous to civilized conditions swallows dwelt chiefly in rocky crevices, hollow trees and holes in earthen banks.

E. I.

SWALLOW-TAIL, the popular name for many species of large butterflies of the family *Papilionidae*. In most species the inner margin of the hind wing is prolonged into a tail-like extension. The larvæ of these insects possess a forked retractile organ just back of the head, which they thrust out when disturbed. This organ is bright-colored, fleshy, and gives

and Gandhi moved toward his goal by launching a movement of passive resistance which involved the Boycott of legislative bodies, courts, schools and foreign goods. Contrary to his intention, this frequently led to acts of violence. To allay popular unrest the British ministry conferred with Indian leaders in London and announced in Jan. 1931 that, with certain reservations, responsible government would be conceded.

E. M. S.

BIBLIOGRAPHY.—A. Osburn, *Must England Lose India?*, 1930.

SWARTHMORE, a borough in Delaware Co., southeastern Pennsylvania. It is situated in the hills near Delaware River, 11 mi. southwest of Philadelphia and is served by the Pennsylvania Railroad. The borough is a residential suburb of Philadelphia, and the seat of **SWARTHMORE COLLEGE**, founded by Quakers in 1864, with a limited student body numbering 500. Crum Creek flows through the beautiful campus. The borough became incorporated in 1893. Pop. 1920, 2,350; 1930, 3,405.

SWARTHMORE COLLEGE, at Swarthmore, Pa., a coeducational, privately controlled, and non-sectarian institution, founded in 1864 by members of the Religious Society of Friends. It had productive funds in 1931 amounting to \$6,200,000. The Sproul Astronomical Observatory, with a special endowment for research, contains an equatorial refractor of 24 inches aperture and a photographic telescope of nine inches aperture. The library of 65,000 volumes includes early writings and manuscripts relating to the Religious Society of Friends. In 1931-32 there were 569 students, and a faculty of 70, headed by Pres. **FRANK AYDELOTTE**.

SWASTIKA, one of the commonest and most universally found of all ornamental motives, consisting of a simple cross with the ends of the arms bent approximately at right angles, always in the same rotary direction, clockwise or counter-clockwise. The form is sometimes known as the tetraskilion. Three-legged varieties are also found, known as the triskilion. The form was probably originally a sun symbol.

SWATOW, a South China treaty port built at the mouth of the River Han on the northern frontier of Kwantung province. The foreign settlement lives on Kakchih Island a mile from the city. Waterworks, electricity and wide roads have been adopted. The chief articles of export in a large coasting trade are sugar and oranges. Rice, sugar and peanuts are grown and bean cake is imported. A distinctive industry of the city is needlework. Opened to foreign trade by the Treaty of Tientsin in 1858, Swatow had its first business carried on at Namoa Island and later at Double Island, 4 mi. below the city. Traders in the early days kidnapped coolies and roused such sentiment that Swatow was long unsafe for foreign ventures. Typhoons have periodically worked havoc in the city. Pop. 1929, 141,063.

SWAZILAND, a British protectorate in south Africa at the southeast corner of Transvaal. It covers an area of 6,704 sq. mi.

In 1890 the administration of this native territory was taken over by the Transvaal government. It is now under control of the high commissioner of South Africa. Jurisdiction over the natives, who are related to the Zulus, is in the hands of native chiefs.

A great part of the area exceeds 5,000 ft. in height. The mean rainfall is over 40 in. and provides excellent pasture all year round, except in the lowland to the east, a malarial country deficient in rainfall. The staple product is maize, and tobacco, millet, peanuts, beans, fruits and sweet potatoes are also cultivated. The area under cotton has increased in recent years. Many sheep are brought here in winter from Transvaal and Orange Free State. Alluvial tin is worked on the eastern border and anthracite coal is mined in the lowlands.

The administrative center is located in the west at Mbabane. Native education is subsidized by the Union of South Africa. Pop. 1921, 112,838, including 2,235 Europeans.

SWEATER MANUFACTURE. See **KNITTING**.

SWEAT GLANDS. See **SKIN**.

SWEAT-HOUSE, in its simplest form, an American Indian structure built of willow rods or other plant stems stuck into the ground and bent and fastened into a hemispherical or oblong framework which was temporarily covered with blankets or skins



AMER. MUS. OF NATL. HISTORY

SWEAT-HOUSE OF A SASKATCHEWAN
TRIBE

to make the enclosure tight. The hut was usually large enough to accommodate several persons. Heated stones were carried on forked sticks and deposited in a hole in the center. These were sprinkled with water to generate steam. Among some tribes heat was produced directly by fire as, for example, by the majority of California tribes. The Eskimo used hot air instead of steam and in Zuni and other Pueblos of Arizona and New Mexico, hot stones were placed near the body to furnish heat. With some Indians the use of the sweat-house was a daily occurrence. After the steaming the bather plunged into a cold stream if one were near. The body was sometimes scraped with wooden or bone scrapers or simply with grass or twigs before leaving the house. The sweat-house was almost universal among all American Indians and was always constructed according to prescribed rules. Among the Thompson Indians (Teit) the door always faced east; among the Kiowa (Mooney) the framework consisted of 12 supports; the southern Plains tribes placed a buffalo skull on

a small mound of earth at the rear. Sweating seems to have been practised for three distinct purposes. First, as a purely religious rite or ceremonial purification of the body or for the propitiation of spirits. Warriors took a sweat-bath before going to war or embarking on any serious undertaking. The offering of prayers in the sweathouse was a general custom. It was frequently part of the ceremonies which marked a boy's arrival at puberty. Second, the religious significance of the house made it an important part of the treatment of disease. Third, it was often purely social and hygienic.

SWEATING SYSTEM, a system of extreme exploitation of labor, in which work is done for virtually unlimited hours, often under the most unsanitary conditions, and for a mere pittance. Sweatshops have usually been associated with disorganized and highly competitive industries like the manufacture of clothing. In tenements or other buildings ill-suited for manufacture, irresponsible contractors or subcontractors would employ workers to sew garments which were usually cut in factories, and given out by the larger employers who dealt with the trade. Competition among the contractors exerted a constant tendency to reduce the amount paid by the manufacturers or jobbers, who had no direct responsibility for the pay or conditions of the workers. The workers were recruited largely from the unskilled, of which there was a surplus in the market, or in the case of the United States, from recent immigrants whose opportunities for employment were limited. The seasonal character of the demand further increased the pressure of the work and lengthened the hours during the busy season. The scattered and numerous places of work made control or inspection of any sort difficult. Reform campaigns against sweating arose not only because persons sympathized with the sufferings of the workers but also because the extent of TUBERCULOSIS and other infectious diseases furthered by the system threatened the public health. Sweating is less prevalent than formerly, but is a constant threat where economic conditions favor it. It has been held in check not merely by factory and sanitary laws, but by the rise and vigilance of LABOR ORGANIZATIONS.

G. S.

SWEDE, in botany, a name given to the Swedish TURNIP or rutabaga, widely grown, especially in northern Europe, for stock food.

SWEDEN, a northern European kingdom, occupying the eastern side of the Scandinavian Peninsula and bounded on the west by the Kjölen mountain range, which separates it from Norway. The Gulf of Bothnia and the River Torneå separate it from Finland on the east. The Baltic Sea is on the southeast and south and the Kattegat on the southwest. The total area of 173,146 sq. mi. includes many adjacent islands, the largest being Gotland and Öland.

Physical Features. The country may be generally described as a land of wide and gently rolling terraces, dropping from a western watershed by definite scarps, at 1,500 and 600 ft. contours; and ending

in lakes, which, as in most recently glaciated countries, are present in large numbers. The proportion of the total surface occupied by inland waters is, with the single exception of Finland, the largest in Europe. The Swedish coast is in marked contrast to that of Norway, being relatively smooth and unbroken while the wide river mouths provide good harbors. The character and position of the main watershed account for the number and the volume of the rivers and the slope of the plateau determines their general direction toward the southeast; but as the plateau sinks to the Baltic the course of the chief rivers is broken by at least three falls or sets of rapids. There are 60 important rivers emptying into the Baltic between Torneå and Gefle. A dozen of these have an average length of fully 200 mi.

Climate. Latitude and the continent have some influence on the climate but the controlling factor is the Gulf Stream. There is a steady latitudinal variation from north to south; the mean annual temperature on the northern frontier is 27° F., and on the southern 45°. Spring begins in the northeast in May, but in the southwest in March, while summer begins in the middle of June in the one and the middle of May in the other; and autumn in the middle of August in the one and October in the other. The lakes in the northeast freeze in October, and remain frozen for 200 days; those in the southwest do not freeze until December, after which they remain so for 100 days. The average annual rainfall is about 20 in., the amount increasing toward the south and west, the southwest having fully 35 in. at Göteborg. As in Norway, the length of day compensates for the shortness of season. The sun is actually visible at midnight at Abisko from May 30 to July 15, and is not visible at noon from Nov. 20 to Jan. 20.

Population. The population in 1931 was 6,310,902. The Swedish people belong to the Scandinavian branch of the Aryan family, and the population is strongly homogeneous. There are about 30,000 Finns and 8,000 Lapps, mainly in the north. STOCKHOLM, the capital, has a population of 502,203, Göteborg has 245,711 and Malmö 127,222.

Minerals. There are two main iron fields in Sweden: the Lapland and the Central. As the Central Field is very conveniently placed for home use, while the cost of freight debars the Lapland ore from a similar market, special provisions have been made for the export trade.

Forest Products. The natural forests of Sweden have played an important part in the economic development of Sweden. They are natural foresters, and their forests are said to be the best managed in the world. The country is of great economic importance as the best source of conifer products in Europe. About 57% of the total area of the kingdom is wooded and this percentage amounts to about 57,000,000 acres. Both the distribution and the character of the forests are largely climatic. The north is naturally colder than the south, conifers there requiring 160 years for perfect rotation compared with

only 80 in the south; but the south bore the brunt of the earlier exploitation. The dividing line is roughly the southern limit of the 1,500 ft. contour, of heavy snow and long winters of 150 to 200 days. It is also the northern limit of the oak flora; but the oak itself, like the beech in the far south, is of no importance except as suggesting soil and climate which encourage clearing for cultivation. The great source of forest exports is the 40,000 sq. mi. of northern Sweden between the 600- and the 1,500-ft. contours, where Scots fir and Norway spruce dominate a belt 600 mi. long and 100 to 150 mi. wide. The fir, which predominates to the north, is a lover of light, and flourishes on the drier convex sections of the plateau; while the spruce, a lover of shade, is found on the wetter concave sections. The existence of the forest is mainly due to the heavy snowfall, while its quality is the result of the relatively considerable proportion of mild and moist winds in winter, minimizing the harm done by transpiration at a season when the trees cannot replace the lost moisture from the frozen soil. The hard snow is, of course, as useful as in Canada for lumber operations, especially transport of logs. Almost everywhere there is water frontage; it aggregates 19,000 mi. and in 1929 delivered at 60 different ports in the Baltic some 450,000,000 cu. ft. at a cost of under \$500 per 30,000 cu. ft. Where rail must be used, it is seven times more costly than water.

Sweden is the premier European producer of wood pulp, as well as soft woods; and the pulp and paper exports, already 50% higher than the wood exports, are steadily rising, while the latter are steadily falling, actually as well as relatively. At the same time, though pulp is displacing wood, and the source of the largest supplies varies from year to year, over the whole area, the increment equals the cut.

Agriculture. The high timber line incidentally indicates a large area of real alp pasture on the higher levels and a still larger area of useful agricultural land on the lower levels. Until about 1880 Sweden produced breadstuffs in excess of her own needs, but now imports about 50% of the grain consumed, mainly because of the competition of the great grain lands of North America and because of the drain of her farm labor into the town industries. This has increased the relative importance of grassland. Southern Sweden has the best soil, the most favorable climate and the most extensive plains of Scandinavia. Here are to be found the most densely populated rural areas and the chief agricultural region. Hay is the major crop of Sweden. In the north it is essentially the only crop because of climate and topography; in the center and south it shares the production acreage with oats, barley and rye; and in the extreme south with wheat and the root crops, especially potatoes and sugar beets.

Sheep make up about one-fourth of the animals raised, and swine constitute 17%. Practically all the cattle are for dairy purposes, their products providing the only important item of agricultural export. In

southern Sweden, there are small farms, cooperative dairies and a considerable export of butter and condensed milk.

Power Development. One of the most serious handicaps to many parts of the country is the freezing in winter, which reduces the flow of the rivers (and falls) and necessitates auxiliary steam power or temporary closing of plants. Sweden, to a far greater extent than Norway, possesses in her mines, forests and farms domestic raw materials available for manufacturing, and for the utilization of her power. Her proximity to Denmark, which has no water power, results in an export of current via submarine cable to that country. Of great significance is the availability of electric power to the rural population. Over 3,600,000 acres of farm land, or 15% of the cultivated area, is electrified, the current distribution being usually handled through cooperative societies. Water power is as yet only partly utilized, and its further exploitation rests in part upon the price of imported coal.

Industry. In spite of the deficiency in coal, Sweden has turned more and more from agriculture to industry and commerce. A few decades ago industrial activities supported only 15% of the population; to-day the proportion is 35% and the value of the industrial products is 50 times that of those produced at the end of the last century. In contrast to the narrow limitations upon agriculture which leave the country deficient in foodstuffs, Sweden has in her forests, iron ores, water power and favorable commercial position the basis of a substantial industrial development. In 30 years Swedish forest products have risen in value from \$25,000,000 to \$170,000,000; at the same time pulp, paper and artificial silk manufacture have grown rapidly, accompanied by a corresponding change in the metal industries second only to wood in export value. The distribution of industrial plants shows a broad band across the southern part of the country between Stockholm and Göteborg. Here water power, iron ores suited for charcoal reduction and transportation are found.

Transportation and Trade. The Göta Canal, built over 100 years ago, joins Göteborg with Stockholm by means of one of the world's most picturesque waterways. Of the 347 mi., more than 200 are natural waterways, including lakes Vettern and Vänern, the Göta River and the Baltic Sea. Though certain areas are still untouched by railways or highways, the mileage of railroad in proportion to the population is the largest in Europe. The wide use of telephone, telegraph and electric light has been a great boon to rural Sweden.

The chief imports are coffee, tobacco, coal, corn, machinery, automobiles, cloth, cotton, wool, fertilizers and copper. The exports are wood products, iron and iron products, ball bearings, matches, electric motors, telephones and cream separators.

Education and Religion. Education is general; the school system is well organized and attendance is compulsory. Almost everyone can read and write.

At Upsala and at Lund there are universities, founded respectively in 1477 and 1668. More than 99% of the total population are Lutheran Protestant, which is the State religion, but complete religious liberty exists.

Finance and Government. The monetary unit is the *krona*, normally equal to 26.8 cents. The Riksbank, established in 1668, is the State bank and has a monopoly on the issue of notes. The revenue and expenditure for the budget year 1930-31 balanced on a sum of \$218,812,000. Sweden is a constitutional monarchy, the King having executive and judicial power under the guidance of a Council of State whose members are responsible to the parliament although selected by the King. There are two chambers of parliament, with equal powers, which sit and vote separately. The First Chamber, with 150 members, is elected for eight years by the provincial and municipal councils of large towns. The Second Chamber, with 230 members, is elected for four years by universal suffrage.

There are three high-court districts, as well as the Royal Supreme Court of Stockholm. Judges are appointed by the king in council.

SWEDEN, HISTORY OF. Archaeological discoveries indicate that Sweden, in common with other Scandinavian states, has a long history. From the evidence thus gathered it appears to have been settled as early as 4000 B.C. At a later time there came from Sweden some of the German tribes that pushed southward across Germany to seek a home in the Roman Empire. But it is only during the Viking period, about 800-1050 A.D., that this remote part of the North emerges clearly on the stage of European history. The Swedish Viking expeditions journeyed mainly eastward, lively intercourse having existed between Sweden and the Baltic shores, especially Finland, even before the Christian era. The existence of considerable trade connections with the Caspian Sea and the Mediterranean region and the foundation, in the 9th century, of the state of Novgorod in Russia testify to the enterprises of the Swedish Vikings, who soon made themselves masters over a considerable part of eastern Europe. Sweden began to unite internally, in that the small provincial units slowly coalesced to form a single kingdom.

One of the consequences of the Viking expeditions was the introduction of Christianity into Sweden. The conversion of the Swedes was begun in 829; but it was not until about 1050 that the missionary efforts of English monks led to the acceptance of the new religion by the Goths. Another century was required to bring the Svear ("Swedes") of Uppland into the fold. The conversion to their King, Eric the Saint (d. 1160), brought them to renounce their old gods; but the country was disturbed for another century by the internal struggles caused by the introduction of Christianity. Eric extended the new creed into the more distant parts of Sweden and made a crusade to Finland, about 1157, where Swedish settlements had existed since time immemorial, and began the process of

amalgamation which was destined to make Finland an integral part of the Swedish kingdom for over 600 years.

During the Folkunga period, 1250-1389, Sweden was brought into closer relations with the rest of Europe, and began increasingly to reflect the social and political conditions which prevailed in the West. The earlier more or less undifferentiated peasantry was broken up by a gradual social stratification; the nobility emerged as a privileged, land-owning class after 1280, and the clergy likewise appeared as a separate and privileged class, in consequence of the growing power of the Church. The laws of the provinces were codified in 1347, and by the end of the century, a national law code had largely replaced provincial laws. The Crown remained elective, a circumstance that gave rise to prolonged internal conflicts. Excepting the rounding-out of the Swedish possession in Finland, no important territorial additions were made.

Union of Sweden, Denmark and Norway. The weaknesses of the elective monarchy, and the growing pretensions of the leading nobles, led in 1363 to the election of Albrecht of Mecklenburg as King. In 1389 the magnates decided to depose him, and offered the Crown to Queen Margaret of Denmark, who had fallen heir to Norway also. The union of the three kingdoms was effected in the same year. It was marked by difficulties from the outset. The policies of Eric, 1412-39, Margaret's successor, led to a peasant rising in Sweden. Led by Engelbrekt, the popular insurrection of 1434-36 precipitated the deposition of the monarch, and served as an introduction to almost unbroken conflict between Sweden and Denmark which lasted till the union was permanently dissolved in 1521. In that year, Swedish resistance to Christian II, 1513-23, came to a head under the leadership of Gustavus Vasa who carried the war to a successful conclusion and was proclaimed King in 1523 as Gustavus I.

Having freed Sweden from political dependence upon Denmark, Gustavus I, 1523-60, proceeded to break down Sweden's economic dependence upon the Hanseatics, and also effected the separation of the Church from Rome. The administration was centralized, the finances were reformed and the defenses improved. He became head of the newly-established Lutheran Church, 1527, and in 1544 succeeded in making the Crown hereditary in his family. The sons of Gustavus engaged in bloody feuds over the succession, and internal peace and order were not restored until the youngest, Charles IX, 1599-1611, became King. Having been ruler for several years before 1599, he was largely responsible for the definitive victory of the Reformation in Sweden over Catholicism (Uppsala Synod, 1593). It was during the disturbed decades after the middle of the century that Sweden became involved in wars with Poland, Denmark and Russia over the control of the eastern Baltic region. Dynastic, religious and political rivalries were setting the stage upon which Gustavus II Adolphus, 1611-32, was destined to play an important part.

A European Power. During the greater part of his reign, Gustavus II Adolphus was busy with wars which extended Sweden's rule to Carelia, Ingria, Livonia and a part of West Prussia. In 1630 he became a participant in the THIRTY YEARS' WAR as champion of the Protestants. By his victory at Breitenfeld, 1631, he raised Sweden to the position of a European Power. Wallenstein was defeated at Lutzen, Nov. 6, 1632, but the King lost his life in the battle. The newly-won position of Sweden was saved by the political genius of Axel Oxenstierna, head of the Regency 1632-44, and the exploits of Swedish generals. The daughter of Gustavus II Adolphus, Christina, was sovereign in her own right when the TREATY OF WESTPHALIA, 1648, registered the gains of the Swedes: control of the mouths of all the main German rivers, and the mastery of the greater part of the Baltic littoral. Three years earlier, Sweden had obtained, by the Peace of Bromsebro, Jamtland, Harjedalen and Gottland from Denmark.

Queen Christina abdicated in 1644 and turned Catholic, and the Crown passed to her cousin Charles Gustavus of Pfalz-Zweibrücken who was crowned King in the same year, Charles X Gustavus, 1654-60. The difficulties experienced at the time by John Casimir, King of Poland, tempted Charles X to begin a war which soon broadened so as to include Denmark, Brandenburg and Russia. The Swedes took Warsaw and Cracow, aided by Frederick William, as a result of the Treaty of Königsberg, 1656; but ultimately Charles X found himself opposed by all the countries named. The Swedish operations against Denmark were successful, however, and by the Peace of Roskilde, 1658, Sweden obtained territories which gave the country natural boundaries to the south. The TREATY OF OLIVA, 1660, with Poland closed the Polish phase of the war and embodied a ratification by Sweden and Poland of the sovereignty of Prussia. In the same year, the Peace of Copenhagen readjusted the Roskilde settlement, but left Sweden in possession of the southern part of the Scandinavian peninsula. In 1661 the Peace of Kardis with Russia provided for reciprocal restoration of conquests.

A Third Rate Power. These major settlements were made in the early reign of Charles XI (Regency during minority, 1660-72; ruling King 1672-97), who devoted most of his attention to domestic problems of pressing import. Finances were improved by the reappropriation of extensive lands granted to the nobles, whose power was thus broken, 1686, and the defenses of the kingdom modernized. When Charles XII, 1699-1718, came to the throne, the country was in a flourishing condition; but his foreign enterprises soon brought it to the brink of ruin. The Northern War, 1700-21, was caused by the determination of Tsar Peter the Great to obtain a foothold on the Baltic, the desire of Poland to absorb Livonia, and the enmity of Denmark. Charles XII was successful at first, but soon met with reverses. When he was killed in 1718, during an expedition to Norway, Sweden had already lost the war. By the TREATY OF NYSTAD, 1721, Sweden

ceded to Russia: Livonia, Estonia, Ingria and a small part of southeastern Finland. Hanover obtained Bremen and Werden, 1719, and in the next year Prussia got Stettin, part of west Pomerania, Wollin and Usedom. Sweden sank to the position of a third-rate Power.

The successor of Charles XII, Ulrica Eleanora, placed the control of the Government in the hands of her husband, Frederick of Hesse-Cassel, 1720-51. For 50 years after the Peace of Nystad, the Crown was reduced to insignificance. The real power was wielded by the Riksdag, in which keen competition in bribery by France and Russia decided the questions of the day. Gustavus III, 1771-92, broke the power of the Riksdag by a coup d'état in 1772, and in 1789 obtained well-nigh absolute prerogatives, but was assassinated in 1792. The revolutionary and Napoleonic period brought new disasters. Gustavus IV, 1792-1809, took sides against Napoleon, and as a consequence lost Finland to Russia, 1808-09, Russia having obtained at Tilsit, 1807, Napoleon's consent to the conquest of the eastern half of the Swedish kingdom. These reverses led to the deposition of Gustavus, and the introduction of Constitutional Government under Charles XIII, 1809-18. In 1810 Marshal Bernadotte of France became heir apparent to the throne. Beginning in 1813, Sweden participated in the European coalition against Napoleon and attacked the traditional enemy, Denmark. Denmark was overrun and in Jan. 1814 was forced to accept the Peace of Kiel whereby Norway was ceded to Sweden.

Together with the complicated questions growing out of the industrialization which became marked during the middle decades, and the question of Parliamentary reform, the union with Norway provided most of the substance of Swedish problems in the course of the 19th century. The Norwegians soon began to chafe under the conditions imposed upon them by the union. Their dissatisfaction, especially with the conduct of foreign relations, which was in the hands of the Swedes and involved such important matters as shipping interests and consular representation, led in 1905 to the dissolution of the union. The legislature of four Estates was modernized in 1866 when it was replaced by a bicameral Parliament.

During the World War, Sweden cooperated with Denmark and Norway in the maintenance of the rights of neutrals. At the close of the war, Sweden claimed the Åland Islands from Finland; but the controversy was settled by the League of Nations in favor of Finland, 1921, Finland to guarantee the rights of the Swedish speaking inhabitants of the islands.

The franchise was markedly liberalized in 1909, but the graduated voting scale was retained. After majorities in favor of further change had been obtained in the lower house in 1916, 1917 and 1918, a further democratic revision of the Constitution was effected. Since 1921 all men and women over 23 years of age have had the right to vote. The lower house consists of 230 members chosen for 4 years. The upper house is composed of 150 members, chosen indirectly for 8

years by citizens 27 years old or over. One-eighth of its membership is renewed yearly. The two chambers are equal in fact as well as in theory, and ministers must command the support of both. The main differences between the two chambers are the longer mandate, indirect election and successive renewal of the membership of the upper house, and the difference in the age of voters competent to select the representatives to the upper house.

J. H. WU.

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SWEDENBORG, EMANUEL (1688-1772), Swedish philosopher and mystic, was born Emanuel Swedenborg at Stockholm on Jan. 29, 1688. He was educated at the University of Upsala. From 1710-15 he traveled extensively in France, Germany, Holland and England in order to study natural philosophy. He returned to Upsala in 1715 to take up the more thorough study of science and philosophy. At this time he came into favor at the court of Sweden, being ennobled in 1719 by Queen Ulrica. As a member of the legislative body and as assessor of the board of mines, he spent the following years in persuasive speaking on topics of an economic nature and in visiting the mining regions of foreign countries. Until 1745 he carried on his scientific work, delving into the mysteries of many natural sciences, including chemistry, physics, engineering, physiology, astronomy, paleontology, anatomy, and mathematics. In paleontology he was the forerunner of the later Scandinavian geologists. In chemistry he carried on revealing experiments on iron, steel, copper and brass. As a physicist he developed a nebular theory of planets, explained the mystery of phosphorescence, and forecast the modern hypotheses of the molecular theory. In physiology and anatomy he made notable investigations of the functions and nature of the brain, the spinal column and the ductless glands.

After 1745 Swedenborg turned completely from science to spiritual philosophy, spending the rest of his life in interpreting the Bible and in publishing his writings concerning the New Church. In his work on the scripture he claimed to be divinely inspired by God himself. He also believed that he was the first man to be inspired with the true new faith and the founder of a new church mentioned in Revelations as the New Jerusalem. He died on Mar. 27, 1772.

Swedenborg believed in a triune God, but not of three persons. He believed the soul, the body, and their operations were the human evidences of God. Furthermore, he believed that God was everywhere, and was the sole spark of life in a dead universe. He believed in a tri-planar existence of men: the highest was the celestial or love plane; the next below was the spiritual or wisdom plane; the lowest was the natural or obedience plane. He conceived a complete similarity between two planes, the lower one of

two planes receiving life from the plane above and every single thing on one plane having a corresponding image on the plane above or below. Each plane of existence has its separate heaven and hell.

Unlike the religious reformers of the 15th and 16th centuries, Swedenborg did not think it necessary to go out and preach his doctrine to the people or to found a new sect. He believed that the doctrine could be accepted by the people without a new sect and without strife.

His writings were voluminous. The best known are: *Arcana Coelestia*, 1749-56; *Opera Philosophica et mineralia*, 1734; *The Infinite, and the Final Curse of Creation; and the Mechanism of the Operation of the Soul and the Body*, 1734; *Oeconomia Regni Animalis*, 1741; *Regnum Animale*, 1744-45; *Heaven and Hell; The Divine Providence*; and *The Divine Love and Wisdom*.

SWEDENBORGIAN, members of a Christian sect known as the Church of the New Jerusalem, or the New Church, are divided into two branches: the General Convention of the New Jerusalem in the United States, and the General Church of the New Jerusalem. The Church was first organized in London, in 1787, on the teachings of Emanuel Swedenborg (1688-1772), a Swedish noble. He held that Revelation 22: 2, was a prediction of a new dispensation initiated in the spiritual world in 1757, whereby man was restored to moral freedom and evil forces were restrained. Swedenborgians believe in God as a Trinity of Essence, not of Persons, and affirm the inspiration of the Scriptures, especially the historical and prophetic books of the Old Testament, and in the New, the Gospels and the Apocalypse. With regard to death and the spiritual world, the sect holds that the world of spirits is entered immediately after death, where Eternal Judgment is delivered. The polity of the church is a modified episcopacy; but each society is free in the administration of local affairs, and its worship is generally liturgical.

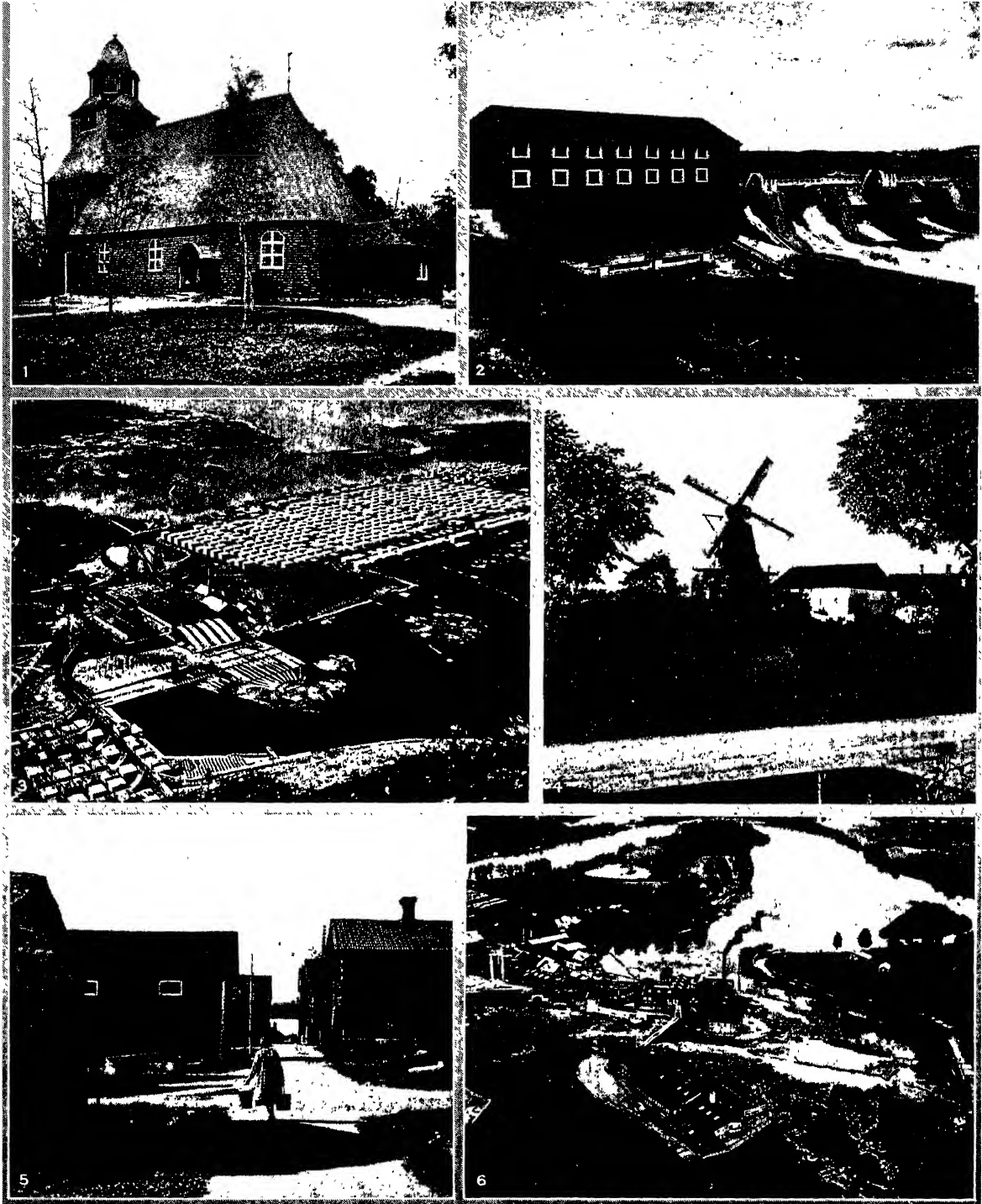
The first New Church Society in America was founded in Baltimore in 1792, and in 1817 the General Convention was established. The division which gave rise to the General Church occurred in 1890. Swedenborgians, though relatively few in numbers, are organized in many countries, and in the United States have their largest memberships in Massachusetts, Pennsylvania, Ohio, New York, Illinois and Missouri.

SWEDISH DRAMA. See SCANDINAVIAN DRAMA.

SWEDISH LANGUAGE, the language spoken in Sweden.

Old Swedish of the East Norse group of the Scandinavian branch of the GERMANIC stock of INDO-EUROPEAN, was spoken in the major part of Sweden, the littorals of Finland, Esthonia and Livonia, and the surrounding islands, as well as in certain parts of Russia, where a state was founded by Swedish vikings in 862. It is preserved in several thousand runic inscriptions, found throughout Sweden and belonging mostly to the 11th and 12th centuries. Old Swedish literature in Latin characters, which begins in the

SWEDEN

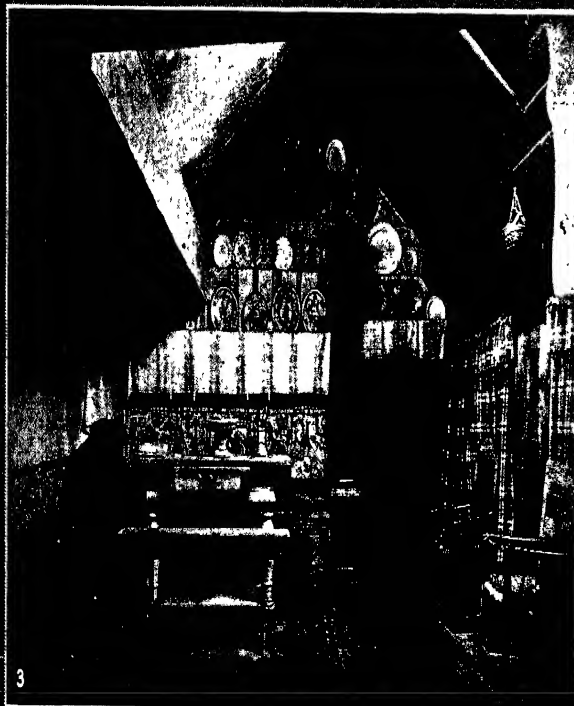


2, COURTESY SWEDISH STATE RAILWAYS; 3, 4, 5, 6, AMERICAN-SWEDISH NEWS EXCHANGE

PROVINCIAL AND INDUSTRIAL SCENES IN SWEDEN

1. Ancient church at Skansen in an architecture found in the Swedish provinces. The edifice was transported from Seglora. 2. A hydro-electric station illustrative of the modern water-power development. 3. The Sandvikens saw-mills at Umea, on the east coast. 4. Wind-

mill in the southern province of Scania. 5. Street view in the village of Vilhelmina, on Lake Volnsjo, showing dwellings typical of the coastal and lake communities. 6. Extensive paper mill of the Molnbacka-Trysil Company in the province of Varmland in southern Sweden.



COURTESY SWEDISH STATE RAILWAYS

CITY AND COUNTRY SCENES IN SWEDEN

1. The Castle of Kalmar, on the Baltic, a well-preserved medieval fortress. 2. View of the village of Mora, in the province of Dalecarlia.
3. Interior of a Dalecarlia farmer's house. The only modern notes are the iron cookstove to the left and the electric light.
4. Aerial view of Riddarholm, in the "old city" of Stockholm.

SWEDISH LITERATURE

13th century, is not equal in quality to the Old Icelandic monuments, but in quantity is superior to Old Norwegian. In the pre-literary period, before 1225, it shows the same archaic character as Old Norwegian and Old Icelandic of the same time. In the next period, until about 1375, Swedish differs distinctly from them, but not yet from Danish; and toward the end of the 14th century it becomes the common language of the whole country. E. Ro.

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SWEDISH LITERATURE is believed to have branched out from the general Scandinavian stem of the Old Norse language at about 1300. The first name of importance is that of St. Birgitta (1302?-73), who recorded some of her visions and made a translation of the *Pentateuch*. From the medieval period there are also a number of folk-songs together with several rhyming chronicles and metrical romances.

Olaus Petri (1497-1573), the apostle of the Reformation in the country, wrote a prose history of Sweden and a mystery play. The secular drama began early in the 17th century with historical, religious and classical subjects, the performances given chiefly by school-boys and university youths. Georg Stjernhjelm (1598-1672) has been called the "Father of Swedish Poetry." Writing under the patronage of Gustavus Adolphus and his daughter Christina, he produced several court masques and the epic *Hercules*, a didactic allegory in hexameters on the conflict between duty and pleasure. His chief gift to literature, however, was his refining influence on the language. In prose the omniscient scholar, Olaf Rudbeck (1630-1702), attempted to prove in his enormous work, *Atlantis*, that Sweden was the ideal nation dreamed of by bards and sages of the past. The study of philosophy was introduced by the great Frenchman, Descartes, who died at Stockholm in 1650.

The period of Sweden's political greatness, which ended in 1718 with the death of Charles XII, was followed by increased activity in literature along the lines of Augustan France and England. The leader here was Olaf von Dalin, poet, essayist, and dramatist, who imitated Addison, Pope, Swift, and Molière. Although without great originality, he exerted an important influence as a stylist. In a similar spirit Gustaf Filip Creutz wrote his charming pastoral *Atis and Camilla*. The novel was introduced by Jakob Henrik Mörk, who somewhat resembles Richardson. The two Swedish writers of this period whose names are best known to the outside world wrote, however, in Latin; viz., LINNÆUS, the founder of botanical study, and SWEDENBORG, the mystic.

It was only in the so-called Gustavian period that Sweden began to produce poetry which has much aesthetic vitality today. Gustavus III, who came to the throne in 1771, was determined to make his country cosmopolitan. He founded the Swedish Academy, laid out parks, built an opera house, and even wrote plays himself. The immortal exponent of his time

was the lyricist, KARL MIKAEL BELLMAN, whose improvised songs picture the gaiety of the new age of rococo with a fire and grace not inferior in their way to the music of Mozart. J. H. Kellgren in satire, and Anna Lenngren in sentiment, are still popular.

The 19th Century. The Romantic movement (*see* ROMANTICISM), which reached Sweden through Germany early in the 19th century, is typified by the brilliant poet, TEGNÉR (1782-1846). Classic in form and Romantic in spirit, he wrote prolifically and reached his highest level in the widely translated *Frithiof's Saga*, a lyric sequence on a legendary Viking story. He was followed by the Finnish epic writer, Runeberg, whose balladic descriptions of the war against Russia are among the finest patriotic poems in modern literature. The fanciful lyricist, Atterbom, and the idealistic nature poet, Stagnelius, represented the increase of personal feeling at this time. The first important novelist, K. J. L. ALMQUIST, introduced a realistic and democratic note. More widely known abroad was FREDRIKA BREMER, feminist and humorist, who not only wrote charming stories of her native Finnland, but also gave an excellent first-hand picture of America in the 1840's. The historical stories of another Finnish poet and prose writer, Zakarias Topelius, had also a wide circle of admirers, among whom was Theodore Roosevelt. The most eminent of Swedish historians, E. G. Geijer was closely associated with Tegnér in the celebration of the past. After a lull toward the middle of the century, a spirited revival followed in all fields of literature. This was characterized by the increase of cosmopolitanism in the direction of religious and social unrest. The militant idealism of Viktor Rydberg appears in his musical lyrics, historical romances and Biblical research. He recalls such English contemporaries as Charles Kingsley and Matthew Arnold. More sensuous in appeal is the poetry of Count Karl Snoilsky, who, however, turned from the hedonistic celebration of Italy to native scene and story.

The dominating genius of recent Swedish literature is AUGUST STRINDBERG (1849-1912), an extreme radical both in thought and style, best known for violent autobiographies, novels and plays directed against women. His brutal realism has in it, however, a liberating urge toward truth which stimulated the entire generation, although few coincided with his opinions. Gustav Geijerstam modified the cruelty of his first stories of peasant life by humor and sympathy in his later work. Verner von Heidenstam's superb poems and historical novels sounded the aristocratic note of loyalty to high tradition. The lyric master, Gustav Frödig, who could be alternately a Burns and a Byron, took an attitude of universal pity and forgiveness. Important in poetry, fiction and criticism, Oscar Levertin stood apart from the other leaders of the '90s in the melancholy, oriental cast of his imagination. The novels of SELMA LAGERLÖF, with their fascinating legendary quality, are unique in a quite different way. More completely imaginary are the tales of Helena Nyblom.

SWEET BAY—SWEET GALE

Swedish literature during the new century continued to be healthily active, with Ellen Key, the noted feminist, Heidenstam and Selma Lagerlof among the leading writers. The most virile poet of Sweden is ERIK AXEL KARLFELDT, who celebrates nature and peasant life, as does the more reflective Anders Österling. In prose, the influence of French realism is noticeable in the short-story masters, Per Hallström and Hjalmar Söderberg. Vigor of design and delicacy of background appear in the work of Sigfried Siwertz. Albert Engström cultivates the humor of low life among sailors and fisher-folk. Literary criticism is ably represented by Fredrik Böök; fine arts by Osvald Sirén and Carl Laurin; adventure and science by the explorer, Sven Hedin, and the ornithologist, Bengt Berg. See also DANO-NORWEGIAN LITERATURE. C. W. S.

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SWEET BAY, a name given in the United States to an attractive species of *MAGNOLIA* (*M. virginiana*) found near the coast from Massachusetts to Florida and Texas. The name is also applied to the true LAUREL (*Laurus nobilis*) of the Old World.

SWEETBREADS, the thymus gland from the neck of young calves. They are considered a delicacy. The pancreas of young beef is sometimes called sweetbread or stomach sweetbread.

SWEETBRIER, a vigorous species of ROSE (*Rosa Eglanteria*) with fragrant foliage, called also EGLANTINE, native to Europe and widely naturalized in eastern North America.

SWEET CLOVER, the common name for a genus (*Melilotus*) of erect, sweet-smelling herbs of the pea family, called also melilot. There are about 20 species all native to the Old World, a few of which have become widely naturalized as field and roadside weeds in the United States and Canada. Of the latter the best known is the white sweet clover (*M. alba*), a biennial, widespread across the continent and increasingly sown, under the name Bokhara clover, for forage, green-manuring and as a cover-crop. It grows from 3 to 10 ft. high, with fragrant leaves of three narrow leaflets, and numerous small, honey-sweet white flowers. The yellow melilot (*M. indica*), a much smaller plant with minute yellow flowers, naturalized from Asia, is cultivated on the Pacific Coast as a cover-crop and green-manure plant. The common yellow sweet clover (*M. officinalis*), with much larger flowers, widespread in the eastern United States, is a native of Europe.

For 1930 the Bureau of Agricultural Economics estimated the total crop of sweet clover hay in the United States at 1,895,000 tons.

SWEET CORN, a variety of Indian corn or maize, characterized by grains more or less wrinkled at maturity, with a translucent appearance, and containing a considerable amount of sugar. Sweet corn is of unknown origin. It was grown by the Indians

and introduced into cultivation by the American colonists in 1779. During the 19th century it won great popularity as a food in America, but has scarcely been appreciated elsewhere. Only the young and tender grains are used, either fresh as "roasting ears" or canned. Numerous strains are now grown, differing in size of ear, color and flavor of the grain, and time of maturing. It is grown in most home gardens and in its different varieties is adapted to a wide range of climatic conditions. Commercially it vies with tomato in importance as a canned vegetable.

Statistics for production and canning in the United States are as follows:

SWEET CORN PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Acreage	Production (Tons)	% of Tot. Prod.
UNITED STATES	315,595	593,300	100.0
LEADING STATES:			
Illinois	58,738	122,000	20.6
Iowa	58,278	99,025	16.7
Minnesota	39,805	93,875	15.8
Indiana	31,600	42,175	7.1
Ohio	27,535	41,725	7.0
Maine	11,770	37,025	6.2
New York	23,973	33,250	5.6

CANNED SWEET CORN, PACK IN THE U.S.

5-Year Average, 1926-30

Division	Production (Cases)	% of Tot. Prod.
UNITED STATES	15,418,000	
LEADING STATES:		
Illinois	2,889,000	18.7
Iowa	2,547,000	16.5
Minnesota	2,003,000	13.0
Maine	1,314,000	8.5
Indiana	1,280,000	8.3

SWEET FLAG (*Acorus Calamus*), a highly aromatic perennial of the arum family. It is found in ditches and other wet places throughout the cooler parts of the Northern Hemisphere and is often planted in bog gardens. From the stout branching rootstock rise numerous narrow sword-shaped leaves, 2 to 3 ft. long, and a similar leaflike stalk from one edge of which is produced a short thumblike spike, densely packed with greenish flowers which in the United States rarely mature seeds. All parts of the plant, especially the rootstock, are pleasingly fragrant and aromatic; the interior of the flower-stalk is sweet to the taste. The dried rootstock furnished the drug calamus, much used in medieval medicine.

SWEET GALE (*Myrica Gale*), a small pleasantly scented shrub of the BAYBERRY family called also sweet willow and bog myrtle. The plant is abundant in bogs and wet soils widely throughout the arctic and cool temperate parts of the northern hemisphere. It grows 2 or 3 ft. high with narrowly oblong, resinous-dotted leaves and numerous small flowers in sessile catkins which appear before the leaves in early spring. The fruit is a small, resinous-waxy drupe. See also WAX MYRTLE.

SWEET GUM (*Liquidambar styraciflua*), a valuable timber and ornamental tree of the witch-hazel family called also red gum, bilsted and satin-wood. It grows in moist soils from Connecticut to Missouri southward to Florida and Texas and also in Mexico and Guatemala. In the eastern states it is often planted for its handsome foliage which in autumn displays colors of unsurpassed brilliancy. The tree grows 80 to 140 ft. high with a straight trunk sometimes 5 ft. in diameter, bearing slender branches, deeply five-lobed, maple-like leaves, small flowers in dense clusters, and woody fruiting capsules united into dense burlike heads suspended on short slender stalks. From the fragrant resinous sap which exudes from the trunk a kind of liquid storax is obtained. In the southern states the sweet gum is one of the most valuable broad-leaved timber trees. The hard, heavy close-grained wood, known to the lumber trade as red gum, is devoted to numerous uses. In 1930 the total cut of red gum lumber in the United States amounted to 69,480,000 bd. ft., valued at the mill at \$19,216,261.60 of which Louisiana contributed 26%; Mississippi, 17%, and Arkansas, 9%.

SWEET LEAF (*Symplocos tinctoria*), a small tree of the sweet leaf family called also horse sugar. It is found in rich soil, often in dense shade, from Delaware to northern Florida and westward to Texas. The short trunk bears slender ascending branches forming an open head sometimes 35 ft. high. The narrowly oblong leaves, yellow-green above and silvery-white below, are greedily eaten by cattle and horses because of their sweet taste. In early spring, the handsome, bright yellow, fragrant flowers blossom in profuse clusters before the leaves appear.

SWEETNESS AND LIGHT, a phrase made famous by MATTHEW ARNOLD, who defined culture as "the passion for sweetness and light, and the passion for making them prevail" (Preface to *Literature and Dogma*). JONATHAN SWIFT used the phrase, in his *Battle of the Books*, 1697, in his fable of the bee which furnishes mankind with "the two noblest of things, 'sweetness' and 'light'" (honey and wax).

SWEET PEA (*Lathyrus odoratus*), a tall climbing annual of the pea family, very popular in cultivation for its showy highly fragrant pealike flowers. It is a native of southern Europe greatly modified in size and color by long cultivation as a garden ornamental. The dwarf sweet pea (var. *nanellus*), a recently developed race, especially the form called Cupid, is a much condensed plant which does not climb.

SWEET POTATO (*Ipomoea Batatas*), a trailing perennial of the morning glory family very widely cultivated in warm climates for its large tuberous roots used for food. While authorities differ as to whether it is of Old World or New World origin, it resembles *Ipomoea tiliacea* of the American tropics of which it may be a cultigen derived through long cultivation. The creeping stems, which root at the joints, bear long-stalked, heart-shaped leaves, large purple flowers similar to those of the morning glory, and oblong or spindle-shaped roots differing from those

of the potato in being sugary as well as starchy.

In tropical and subtropical countries the sweet potato is the most widely used root vegetable. It ranks second in value to the potato among root crops produced in the United States, where it is grown chiefly in the South. The plant delights in sandy loams. Even land depleted of humus by other crops will grow it profitably when supplied with fertilizer. It is propagated by selected roots planted in hotbeds in late winter or early spring. These develop plants called "draws" which are pulled up and planted in the fields and given clean cultivation until the vines cover the ground. Sweet potato roots are dug in the fall, sorted and stored in warm, dry quarters until needed.

SWEET POTATO PRODUCTION, U.S.,

4-Year Average, 1927-30

Division	Acreage	Production (Bu.)	% of Tot. Prod.
UNITED STATES	851,000	81,862,000	100.0
LEADING STATES:			
Georgia	123,000	10,501,000	12.8
Nor. Carolina	86,000	9,155,000	11.2
Texas	114,000	8,817,000	10.8
Louisiana	82,000	7,509,000	9.2
Mississippi	59,000	6,621,000	8.1
Virginia	45,000	5,652,000	6.9

In 1927 the commercial crop marketed in the United States amounted to 93,928,000 bu. valued at \$77,490,600, Texas, North Carolina and Georgia each producing about 10% of the total.

SWEET-SCENTED SHRUB. See ALLSPICE, CAROLINA; CALYCANTHUS.

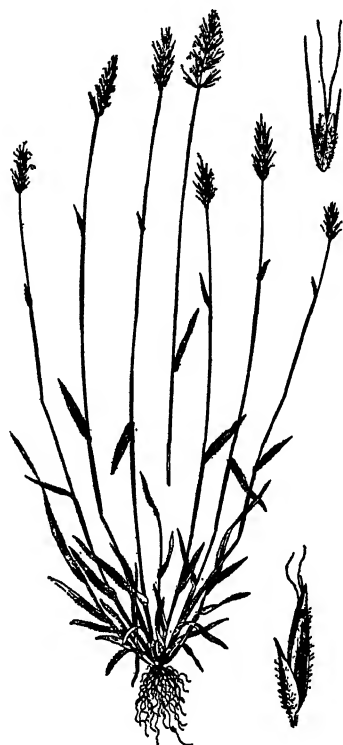
SWEET SOP (*Annona squamosa*), a small tree of the custard apple family called also sugar-apple. It is a native of tropical America, widely cultivated in warm regions for its very sweet custard-like fruit, used for making jellies and preserves. The tree grows 10 to 20 ft. high with oblong leaves, greenish-yellow flowers and a smooth, yellowish, somewhat globular fruit, about the size of an orange.

SWEET VERNAL GRASS (*Anthoxanthum odoratum*), a sweet-smelling perennial native to Europe and Asia and naturalized in fields and meadows nearly throughout North America. It grows 1 to 2 ft. high with smooth erect stems, short, flat leaves and spikelike flowering panicles. The herbage, like that of the holy grass, contains large quantities of coumarin which may be detected by chewing or drying the stalk. Although it has no forage value it is sometimes mixed with meadow grasses to impart its pleasing fragrance to the hay. The Indians use the stems in weaving scented baskets.

SWEETWATER, a city and the county seat of Nolan Co., northwestern Texas, situated about 200 mi. west of Fort Worth. Three railroads, bus lines and airplanes serve the city. The chief crops of the vicinity are cotton and small grain. Gypsum, oil and cottonseed products are the principal manufactures. In 1929 the retail trade was valued at \$6,611,666. The

city was founded in 1881 and incorporated in 1889. Pop. 1920, 4,307; 1930, 10,848.

SWEET WILLIAM (*Dianthus barbatus*), a smooth perennial of the pink family closely allied to the garden pink, sometimes called London pride. It is a native of Europe and Asia long commonly grown in gardens and more or less naturalized in the eastern United States. The erect, rather stout, four-angled stems, 1 to 2 ft. high, bear narrow leaves and showy pink or whitish flowers in dense terminal clusters. Numerous double-flowered kinds and various hybrids with other related species are cultivated. In the east-



SWEET VERNAL GRASS
Plant in flower, spikelet (below) and
florets (above)

ern United States a pink-flowered phlox (*P. maculata*) is called sweet william.

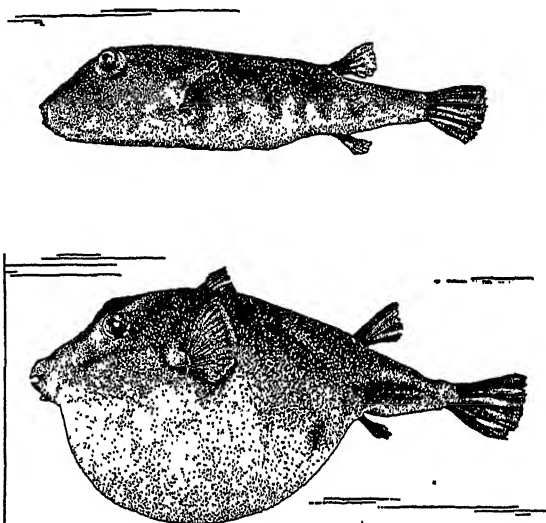
SWELL, or ground swell, the long, slow and heavy wave produced by a severe storm of long duration. It may run over tremendous distances from the original center of disturbance, and is often observed at sea during clear, calm weather.

SWELLFISH, a large family (*Tetraodontidae*) of remarkable marine fishes allied to the porcupine fishes, called also PUFFER and GLOBE FISH, found most numerous along tropical coasts. They are mostly short-bodied, rather thick fishes, with a powerful, somewhat parrotlike beak, and spiny or prickly skin. When disturbed they inflate themselves to a grotesque size. Swellfishes are of little value as food; some are poisonous. Representative American species are the

smooth swellfish (*Lagocephalus laevigatus*), sometimes 2 ft. long, ranging from Cape Cod to Brazil, and the northern swellfish (*Sphoeroides maculatus*), about 10 in. long, occurring from Cape Ann to Florida.

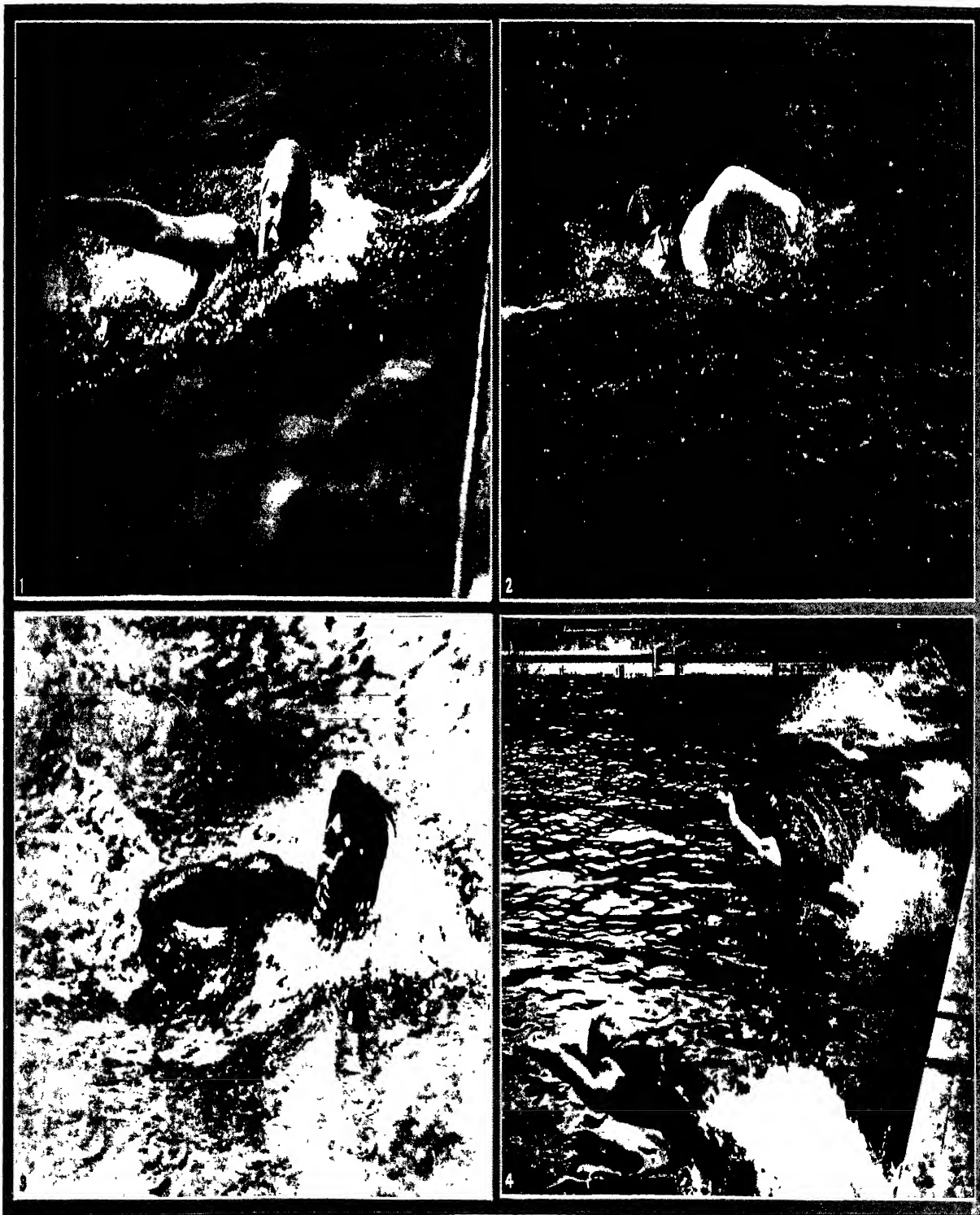
SWEYN (?-1014), King of Denmark, gained the Danish throne by a revolt in 986 against his father, Harold Bluetooth, in which the latter was killed. In 994 he began a series of raids against England, which for 23 years yielded him huge sums in DANE-GELD. His war against Norway, ending with the famous sea-battle off Svolde in 1000, added substantially to his possessions. Sweyn died at Gainsborough, England, on Feb. 13, 1014.

SWIFT, JONATHAN (1667-1745), Irish satirist and Dean of St. Patrick's, Dublin, was born in Dublin,



NORTHERN SWELLFISH
Normal and inflated

Nov. 30, 1667. He was educated at Kilkenny School and Trinity College in his native city and then lived in England for five years as secretary to Sir William Temple. He returned to Ireland to take holy orders in 1694 but soon resumed his position in Temple's household where he remained until his patron's death in 1699. Swift then went to Ireland again and after some years as rector of a country parish was appointed in 1713 Dean of St. Patrick's. Swift was deeply interested in the political battles of the time and his mastery of satire and invective caused constant demand for his pen in the political pamphleteering that was then at its zenith, in which there was none more active, more popular or more effective than he. A powerful figure in politics and society, he was one of the first to inspire and cultivate public opinion and wield it as an important factor in public life. Of all his voluminous works, the most famous is *GULLIVER'S TRAVELS*, a caustic satire on the politics



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COURTESY L. DE B. HANDLEY, ESQ.

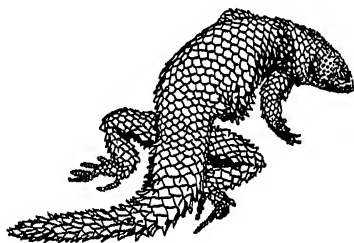
NOTED MEN AND WOMEN SWIMMERS

1. Helene Madison of Seattle, holder of many swimming records.
2. Gertrude Ederle of New York, first woman to swim the English Channel.
3. John Weissmuller of Chicago, former free-style record holder.
4. The start of an Olympic back stroke race.

of his own time and human nature in general, which becomes, when slightly edited, a children's classic because of its striking story interest. It holds an immortal place in the world's great literature. Swift's *Battle of the Books* and *The Tale of a Tub*, mordant satires ridiculing controversies of the time, were both published before he was thirty. The *Journal to Stella*, in which Swift immortalized Esther Johnson, is interesting for its record of his life and character during his busiest years, and also for its pictures of contemporary England. (See also STELLA.) The poem, *Cadenus and Vanessa*, was inspired by and written for Esther Vanhomrigh. The greatest of English satirists is also one of the most tragic figures in English literary history. He suffered much from illness in his latter years and finally sank into complete mental darkness lasting until his death in Dublin, Oct. 19, 1745. See also ENGLISH LITERATURE; SATIRE.

BIBLIOGRAPHY.—Sir Leslie Stephen, *Swift*, 1882; Sir Henry Craik, *Life of Jonathan Swift*, 1894; J. C. Collins, *Jonathan Swift*, 1902; Carl Van Doren, *Jonathan Swift*, 1930.

SWIFT, a common name given to certain small lizards on account of the speed of their movements. The small-scaled swifts (*Uta*) are found in northern Mexico and in the southwestern part of the United States. They are usually gray or brown, marked



COLLARED SWIFT

with darker rings or blotches. The spiny-scaled swifts (*Sceloporus*), whose sharp, outstanding scales make them appear to bristle with armor, live in Central America, Mexico, and the Southwest states. A few forms are found east to Florida or north to Oregon.

SWIFT, the common name for a numerous family (*Micropodidae*) of small birds resembling the swallows in appearance but in structure more nearly allied to the hummingbirds. There are about 100 forms, distributed very widely throughout the world. They have short curved bills, very long pointed wings, weak feet and generally darkish plumage. In rapidity and power of flight they are perhaps unsurpassed among birds. Gregarious and living chiefly on the wing, they capture their insect food in the air, often flying hundreds of miles each day between their nests and their feeding grounds. Most swifts breed in colonies, often of vast size, building remarkable nests, which are cemented together or attached to the wall of a hollow tree or the side of a cliff by means of their sticky saliva. Usually swifts lay two immaculately white eggs.

The common species of eastern North America,

breeding from central Canada to the Gulf coast and wintering southward, is the chimney swift or chimney swallow (*Chaetura pelagica*), so called from its habit of nesting in disused chimneys. Where the chimney swifts spend the winter is still a mystery.

The glutinous nests of certain swiftlets (*Collocalia* sp.), composed almost entirely of dried saliva, are highly prized in Oriental countries for food, furnishing the bird's-nest soup of the Chinese. A. B. J.

SWIMMING. Contests in swimming undoubtedly have taken place from time immemorial. There is evidence they were part of athletic activities in the days of Greece and Rome. Standardized competition, however, apparently was not introduced until the latter half of the 19th century. Diligent research has failed to reveal trace of it before 1869, when the Metropolitan Swimming Association of England conducted the first amateur championship of Great Britain over a one-mile course in the Thames. T. Morris won it with favoring current in 27 min., 18 sec. The earliest championship of the United States, also at one mile, was held in New York in 1877 and captured by R. Weissenborn in 45 min., 44½ sec.

Development was rapid in the years which followed. Not only were swimming organizations formed in many countries, but rules drafted and the number of title tests increased. At present national associations control water sports throughout the world, while the Federation Internationale de Natation Amateur, launched in London in 1908, supervises international affairs, defines Olympic policies and attends to the registration of world records.

In the early stages nearly all standardized competition was done in open water. But in recent years the tendency has been to use pools and make them uniform in length. The majority of indoor pools measure 25 yards or 25 meters; the outdoor, 55 yards or 50 meters. These dimensions are preferred because the classic swimming distances in the English-speaking countries are 100, 220, 440, 880 yards and one mile; elsewhere the approximate metric counterparts are 100, 200, 400, 800 and 1,500 meters.

At first contestants used any stroke they pleased in all races. But when new and faster methods of swimming were evolved, causing devotees of the breast and back strokes to be outclassed, separate fixtures were instituted for the latter, and unrestricted contests came to be known as free style events.

Great Britain, pioneer in the field, for a short time produced the ablest racing swimmers. Then international leadership passed on to Australia and remained there a considerable time. Next Germany had a brief claim. Finally the United States forced to the front and now has been in the van for well over a decade. Among the champions whose exploits may be said to mark milestones in the annals of modern competition are: Barney Kieran and Andrew Charlton, of Australia; Duke Kahanamoku, of Honolulu; Arne Borg, of Sweden; Charles Daniels, Norman Ross and John Weissmuller, of the United States; Miss Fannie Durack, of Australia, and the Misses Ethelda Bleibtrey,

Gertrude Ederle, Martha Norelius, Josephine McKim and Helene Madison, of the United States. All but Kahanamoku, a sprinter, who during 12 years held the world's record for 100 yards, were or are all-around swimmers, having set a number of long enduring standards.

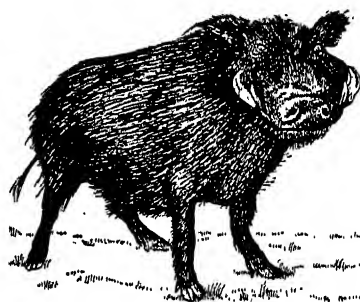
Probably the outstanding feats of each were: Kieran, one mile, 23 min., 15 $\frac{4}{5}$ sec., 1905; Daniels, 220 yards, 2 min., 25 $\frac{2}{5}$ sec., 1909; Kahanamoku, 100 yards, 53 sec., 1917; Ross, 880 yards, 11 min., 24 $\frac{1}{2}$ sec., 1920; Charlton, 880 yards, 10 min., 51 $\frac{4}{5}$ sec., 1924; Borg, 1,500 meters, 19 min., 7 $\frac{1}{5}$ sec., 1927; Weissmuller, 100 yards, 51 sec., 1927, 220 yards, 2 min., 9 sec., 1927; Miss Durack, one mile, 26 min., 8 sec., 1914; Miss Bleibtrey, 100 yards, 1 min., 3 $\frac{3}{5}$ sec., 1921; Miss Ederle, 220 yards, 2 min., 46 $\frac{4}{5}$ sec., 1923, and conquest of the Channel, breaking the men's record for the course (1926); Miss Norelius, 400 meters, 5 min., 39 $\frac{3}{5}$ sec., 1928; Miss McKim, one mile, 24 min., 49 sec., 1928; Miss Madison, 100 yards, 1 min., 1931, and one mile, 24 min., 34 $\frac{3}{5}$ sec., 1930. L. de B. H.

SWINBURNE, ALGERNON CHARLES (1837-1909), English poet and critic, was born in London, Apr. 5, 1837. He was educated at Eton and Oxford and in his youth began to reveal the gift that was to place him among the most celebrated poets of his century. One of Swinburne's greatest works, the lyrical tragedy, *Atalanta in Calydon*, was published when the author was 28. The famous *Poems and Ballads* appeared in the following year and aroused a violent storm of criticism because the frankness with which it sang the more sensual side of love offended mid-Victorian taste. But among liberal readers its beauty and music won enthusiastic recognition, and the poet was soon accorded high position among contemporary poets. Some of Swinburne's other notable poetic works are *Songs Before Sunrise*, *Song of Italy*, *Songs of the Springtides*, the second and third series of *Poems and Ballads*, *Astrophel*, *Erechtheus*, *Tristram of Lyonesse*, and *A Century of Rondels*. He produced also a considerable body of critical prose works, chief of which are his *Study of Shakespeare*, *The Age of Shakespeare*, *A Note on Charlotte Brontë*, *Essays and Studies*, *Prose Miscellanies* and studies of Ben Jonson, Victor Hugo and William Blake. His poetry is unexcelled in the English language in metrical ingenuity and variety, melody, exquisite lyric beauty and the impassioned spontaneity of its flow of words. In both ideas and form the revolutionary spirit was strong in his verse and his influence on the writing and the appreciation of English poetry has been liberalizing and enriching. Swinburne's best work was done in the early part of his life. The poet was 42 when his health was threatened and he lived in complete retirement at Putney with his friend, Theodore Watts-Dunton. Although he still wrote, he produced only shadows of his former vivid verse, until his death at Putney, Apr. 10, 1909.

BIBLIOGRAPHY.—Sir E. G. Gosse, *Life of Algernon Charles Swinburne*, 1917; H. Nicholson, *Swinburne*, 1926; S. G. Chew, *Swinburne*, 1929.

SWINDON, a municipal borough and railway junction of Wiltshire, England, about 77 mi. west of London. The old town, built upon a hill and traditionally named after Sweyn, father of Canute, attained sufficient intrinsic value in the 11th century to interest the wealthy Odo. The new town with its community-supported hospitals, large parks and other modern municipal features, has sprung up in a wasteland strip to accommodate the thousands employed in the large locomotive works. Other inhabitants of Swindon are engaged in corn-mills, clothing factories and the quarries of the vicinity. Pop. 1921, 56,841; 1931, 62,407.

SWINE, a group (*Suina*) of cloven-footed animals containing three families: the hippopotamuses; the typical pigs (*Suidæ*), and the peccaries (*Tayassuidæ*). Excepting the hippopotamus, the members of these



COURTESY AMER. MUS. OF NAT. HISTORY
AFRICAN FOREST PIG (*Hylochoerus*)

groups are of moderate size; tread on two central toes, with the second and fifth toes hanging above and behind the feet; have long heads, with terminal nostrils, movable snouts, and a mouth armed with large canine teeth (tusks), which in the males are capable of inflicting dreadful harm even to large animals. Swine have thick skins, in most species scantily haired, are dark-colored, and when adult are unmarked; but the first coats of the young are spotted or streaked with white. From the widely distributed typical wild pig (*Sus scrofa*) of the Old World are descended our domesticated hogs. They are fond of wallowing in mud and water, and obtain their food largely from roots and tubers dug up with their rooting snouts and strong teeth. See BOAR, WILD; HOG; WART HOG; PECCARY; BABIRUSA. E. I.

SWINNERTON, FRANK ARTHUR (1884-), English novelist and critic, was born at Wood Green, Aug. 12, 1884. His studies of GEORGE GISSING and ROBERT LOUIS STEVENSON have established his reputation as a critic, but it is as a novelist and writer of short stories that he is best known. Swinnerton's plots are ingenious, and his descriptions vivid. Among his novels are *The Young Idea*, 1910, *The Happy Family*, 1912, *On the Staircase*, 1914, *Nocturne*, 1917, *Young Felix*, 1923, *The Elder Sister*, 1925, *Summer Storm*, 1926, *A Brood of Ducklings*, 1928, and *Sketch of a Sinner*, 1929.

SWISS CHARD, a name given to a variety of the garden BEET grown for its large leaves, the fleshy midribs of which are used as a potherb. See CHARD.

SWISS LITERATURE. There is no real vernacular literature in Switzerland, but there is a national literature written in French and German, and, to a lesser degree, in Italian, and in the Romansch-Ladin dialects. Since German was in general use until the 18th century, the German-Swiss literature is the most truly national of all these.

Much of the early literature comprises songs and chronicles, first written in Latin and later translated into German. The first original work in German was a history of Switzerland by Johannes Stumpf, 1584. The 18th century was the most flourishing in German-Swiss letters, due to the important work done in history and science and to the attempts of J. J. Bodmer (1698-1783) and J. J. Breitinger (1701-76) to break down the old literary traditions. Also important in this and the early 19th century are J. D. Wyss (1743-1818), author of *The Swiss Family Robinson*, and his son J. R. Wyss (1781-1839).

With the arrival in Switzerland of many French emigrants in the 18th century, a French-Swiss literature was stimulated into immediate importance, especially toward the middle of the century when Rousseau and Voltaire settled there. But the greatest writers, Rousseau, Madame de Staël and Benjamin Constant, though of Swiss birth, are not properly included among Swiss writers (see separate articles on these authors). A contemporary of Madame de Staël, Isabelle de Charrière (1740-1805), is noted for her *Caliste*, *Le Mari Sentimental* and her *Lettres neuchâtelaises*. Notable recent writers in French-Swiss are Jean Gremaud (1832-97), the historian; Marc Monnier (1827-85); and the novelists V. Cherbuliez (1829-90) and Edouard Rod (1857-1910). In Italian and the Romansch-Ladin dialects, the main publications were poetry and translations. See also FRENCH LITERATURE; GERMAN LITERATURE.

BIBLIOGRAPHY.—J. Baechtold, *Geschichte der deutschen Literatur in der Schweiz*, 1829, ed. by T. Vetter, 1919; P. Godet, *Histoire Littéraire de la Suisse française*, 1895; H. E. Jenny and V. Rossel, *Geschichte der schweizerischen Literatur*, 1910; E. Korrodi, *Schweizerdichtung der Gegenwart*, 1924.

SWISS MERCENARIES. It was the general practice of medieval rulers to hire foreign soldiers or mercenaries to fight in their armies. The pikemen of Italy and Switzerland were regarded as particularly desirable fighters, and after 1444, when a small Swiss force wreaked havoc with a much larger Austrian army at St. Jakob an der Birs, the Swiss were the most sought after of all military hirelings. They were brave and reliable and boasted an excellent order and discipline. The cantons were quite ready to swell their revenues by the sale or hire of Swiss soldiers, more especially since the small size and geographic conformation of the land made it profitable to find some means of employing a large proportion of the population beyond the cantonal borders. Naturally, there was occasional dissent to this procedure.

In a treaty of 1452, a group of cantons agreed to

furnish Charles VII of France with several thousand troops, and this arrangement was renewed under Charles's successors, Louis XI, Charles VIII and Louis XII. Then the Swiss and the French came to blows in 1515, and Francis I defeated the cantons in the Battle of Marignano. In the treaty of Fribourg which followed, 1516, the Swiss agreed to permit annual French levies of from 6,000 to 16,000 men. Swiss mercenaries were used extensively during the religious wars of the 16th and 17th centuries, particularly in the THIRTY YEARS' WAR, 1618-48, and then during the dynastic wars of the late 17th and 18th centuries. In practically all of the mercenary agreements which they negotiated, the cantons demanded, among other things, the right of free admission for a number of Swiss scholars to the foreign universities.

Under the circumstances it was natural that Swiss mercenary armies should sometimes be sent to fight against one another. This they generally refused to do, and so, as the continental wars became wider in their scope, the Swiss soldiers became less useful. After the introduction of national standing armies consequent upon the French Revolutionary period, the demand for mercenaries further declined. The Swiss bodyguard of the king of France was dispensed with permanently in 1830, and the Swiss Constitution of 1848 prohibited the negotiation of new mercenary engagements. In 1859 a formal proclamation against the further enlisting of Swiss soldiers in foreign mercenary armies was issued and the century-old "traffic in Swiss blood" came to an end. The institution of peacefully occupied Swiss Papal Guards, however, has continued.

W. C. L.

SWISSVALE, a borough of Allegheny Co., southwestern Pennsylvania, situated on the Monongahela River, 6 mi. southeast of Pittsburgh. It is served by the Pennsylvania and the Baltimore and Ohio railroads. Swissvale has various manufactures, including railroad signals, glassware, cotton waste, automatic machinery, foundry crucibles, forgings, and drafting-room instruments. The retail trade in 1929 amounted to \$3,468,525. The borough was incorporated in 1897. Pop. 1920, 10,908; 1930, 16,029.

SWITCHBOARDS, panels on which are mounted the necessary apparatus for switching, controlling or metering the electrical energy being distributed to various apparatus, circuits and power lines. With low voltage the BUS-BARS are mounted on the back; with high voltage they are remotely located and switching is done by control circuits. See SELECTIVE CONTROL. Modern boards are commonly of slate and sheet metal.

SWITCH GRASS (*Panicum virgatum*), a vigorous perennial, native to the eastern half of the United States and southward to the West Indies, sparingly grown for ornament. In various parts of the interior it forms a constituent of prairie hay. The erect stems, 3 to 6 ft. tall, growing in dense clumps from creeping rootstocks, bear long, flat, taper-pointed leaves and a large, spreading flowering panicle sometimes 20 in. in length.

SWITHIN—SWITZERLAND

SWITHIN, ST. (?-862), bishop of Winchester, was born early in the 9th century in the England of King Ethelwulph's days. His meek and charitable nature as well as his learning won the confidence of the King, who made him his chief counselor. His death is found recorded in the *Anglo-Saxon Chronicle* as of 861, but other evidence seems to point to 862 as a more authentic date. When his remains were transferred a century later to be enshrined in Winchester Cathedral, legend avers that it rained in torrents and for many days thereafter. This is possibly the origin of the superstition with reference to rain on that day. St. Swithin's day is celebrated on July 15.

SWITZERLAND (German *Schweiz*; French *Suisse*; Italian *Svizzera*), a confederation of small states called cantons, 19 whole and 6 half cantons, situated in Central Europe between $47^{\circ} 48\frac{1}{2}'$ and $45^{\circ} 49'$ N. lat. and $5^{\circ} 57\frac{1}{2}'$ and $10^{\circ} 29\frac{3}{4}'$ E. long. It is bounded on the north by Germany, on the east by Austria and the Principality of Liechtenstein, southeast and south by Italy, and southwest, west and northwest by France. There are a few natural boundaries, including Lake Constance, the Rhine, Lake Geneva and Italian lakes. The area is 15,940 sq. mi. and its greatest length, southwest-northeast, is about 225 mi., its greatest breadth, north to south, about 136 mi.

Physical Features. There are three main regions, the Jura Mountains, 12% of the area, the Middle Land or plateau, 30%, and the Alps, 58%. The plateau is the most cultivated and populous section of Switzerland. The greater part of the country is drained by the Rhine and its tributaries, while the Rhone, the Po, the Danube and the Etsch systems water the rest. There are many beautiful lakes. Lake Constance, the Lake of Geneva, Lago Maggiore and the Lake of Lugano are partly in Switzerland and wholly within its borders are others, including the lake of Neuchâtel, Zürich, Lucerne, Thun and Brienz. Switzerland has 700 sq. mi. of glaciers.

Climate. The climate is Central European, but has great divergencies owing to altitude and exposure. The southern slopes of the Alps and the northern coast of Lake Geneva are favored by warm breezes. Switzerland's great varieties of climate make it not only a popular resort for winter sports and mountain climbing, but also favor countless sanatoria from the Alpine heights to the subtropical coasts of the lakes on the south. The average January temperature in Basel, 909 ft. altitude, is 31.8° F., in Davos, 5,121 ft. altitude, 18.1° F., and in Bevers, 15,610 ft. altitude, 14.2° F. In the hottest month, July, the average records were Basel, 66.4° ; Davos, 53.8° ; Bevers, 53.2° . Precipitation also shows wide differences. Basel has 32.5 in. per annum, Davos 37.5 in., and Santis 95.7, mostly snow.

Population. The population of Switzerland in 1930 was estimated at 4,054,400. The most densely populated cantons and half cantons are Basel-Stadt, Geneva, Zürich, Appenzell-Ausser-Rhoden, Basel-Land and Aargau. The four largest cities are Zürich, Geneva,

Basel and Bern, the capital, each with a population of more than 100,000. According to the last census, the population was divided by languages as follows: German-speaking, 2,750,222, east and center; French, 824,320, in the west; Italian, 238,544 in Ticino and Graubünden, and 42,940 speaking Romansch, an old Romance language which has survived in the eastern Alps. Resident foreigners number about half a million and include 150,000 German citizens, 135,000 Italians, 57,000 French and 22,000 Austrians.

The Swiss belong to the Germanic race, excepting the west and southeast, which are inhabited by Celtic and Romance peoples. The peasants have maintained many ancient customs and usages, especially in Graubünden, Wallis and Ticino. The form of small peasant settlements is very ancient. The Alpine log house divided into home and barn is the oldest type, while the isolated farmhouse was introduced by the Allemanic invaders. Wood-carving, spinning and iron-working are highly developed and the local customs are quaint.

Religion and Education. In 1920 there were 2,230,597 Protestants, 57.4%, 1,585,311 Catholics, 40.8%, 20,979 Jews, 0.5%, and 43,433 others. The Reformed Church is organized in cantonal synods and the Catholics are under the supervision of six bishops. The Old Catholic Church has a bishop at Bern for the entire country.

The National Technical University at Zürich is under the government of the Confederation, but all other educational institutions are maintained and supervised by the cantons and differ greatly. It is compulsory for children from their sixth or seventh year to attend free primary schools for six to eight years. The secondary schools are usually optional. There are also preparatory schools and academies, literary, technical, and many vocational and trade schools of all sorts, not to mention the large number of boarding schools. There are seven cantonal universities, a Catholic theological faculty at Lucerne and a commercial college in St. Gall.

Production and Industry. According to the census of 1920, 26.3% of the earning population were engaged in agriculture and forestry, 45% in mining and industry, 11.7% in commerce and 4.9% in transportation. In 1924, 22.5% of the land was uncultivated, 21.8% was forests, 48.6% grazing land and meadows, and but 6.8% was planted in grain and vegetables and 0.3% in grapes. Grain growing, limited as it is by soil and climate, has decreased of late in favor of grass growing, so that in 1927 four times as much as the domestic crop had to be imported. Viniculture has also declined, especially in the eastern cantons, though Waadt, Wallis and Neuchâtel still furnish excellent wines. Considerable fruit is grown in the northeast. The animal industry is of great importance. In 1926 there were 140,000 horses, 1,587,000 cattle, 637,000 hogs, 170,000 sheep, 289,000 goats, 4,177,000 fowls and 263,000 swarms of bees. The dairy industry is notable and nearly half the product is in the form of cheese and condensed

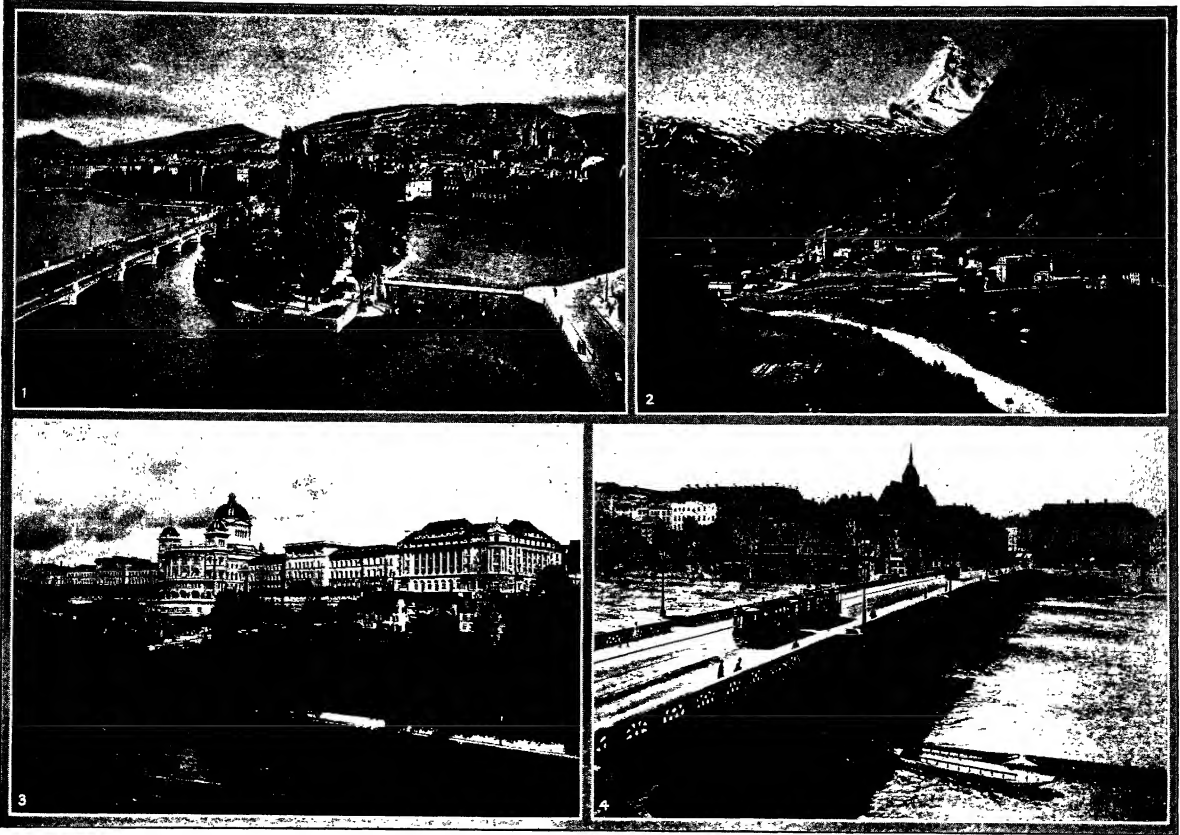
SWITZERLAND



COURTESY SWISS FEDERAL RAILWAYS

SUPERB VIEWS AMONG SWISS ALPS AND LAKES

1. Lucerne and the Lake of Lucerne with the Swiss Alps in the background. At the left is the twin-towered Hofkirche.
2. Locarno, on Lake Maggiore, a popular health resort. In 1925 the chief European powers signed here the treaty known as the Locarno Pact.



COURTESY SWISS FEDERAL RAILROADS

SWISS MOUNTAINS, LAKES AND CITIES

1. Geneva, showing Rousseau's Island. Mont Blanc glistens in the distance.
2. Zermatt, with the snow capped Matterhorn in the background.
3. The Swiss Federal Palace at Berne, the capital city of Switzerland.
4. Basle, showing the bridge over the historic river Rhine.

milk. Hunting is negligible, owing to the cutting down of lower forests. Fishing is important, as the streams are stocked with many millions of small fish annually. The value of the fish caught in Lake Constance and Lake Neuchâtel averages about \$200,000 annually.

Mining is unimportant. Salt is present, and asphalt some antracite and manganese occur in the Jura Mountains. Numerous quarries furnish granite, limestone, marble and gypsum. There are famous mineral springs at St. Moritz, Ragaz and elsewhere.

Despite the lack of raw materials, manufactures are highly developed, owing to the favorable situation of Switzerland, the ability and industry of its people, and its wealth in water power. In 1928 of a potential 4,000,000 horse-power, 1,240,000 was in use. In 1927 the number of factories was 8,238 with 366,350 workers. St. Gall is the center of the embroidery industry, founded in 1840. The silk industry has 177 plants with 25,500 workers, chiefly in Zürich, Baden, Winterthur and Basel. Machines are made in 759 factories by 64,700 workmen in Zürich, Winterthur, Neubausen and elsewhere. The watch and jewelry industry is carried on by 42,520 men in 1,113 shops. Other important manufactures are of metal goods, wooden ware, clothing, chemicals and food products, such as chocolate, condensed milk and beer.

Trade and Transportation. Switzerland's position between central and southern Europe furthers its brisk trade, the centers of which are Zürich, Basel, St. Gall and Geneva. The value of the foreign trade in 1927 was \$515,000,000 imports and \$406,000,000 exports. The chief imports were grain, \$54,000,000, machines and iron goods, \$41,000,000, and silk, \$52,000,000. The chief exports were silk, \$62,000,000, cotton goods, \$60,000,000, clocks and watches, \$55,000,000, and machines and iron goods, \$45,000,000. The largest amounts of imports came from the following countries in the order named: Germany, France, Italy, United States, Great Britain. The exports went to Germany, Great Britain, United States, France, Italy.

The roads in Switzerland are excellent, the Alpine roads being famous. The network of railways in 1926 totaled 9,140 mi., of which nearly one-fourth is narrow gauge, and smaller stretches of funiculars and street railways. The Jungfrau Railway is the highest and in Graubünden and elsewhere railroad bridges extend from alp to alp at dizzy heights. The great tunnels are the Gotthard, Simplon and Lötschberg.

The rivers are not suitable as waterways, but the Rhine is to be improved between Basel and Lake Constance. The Rhine port at Basel is an important inland harbor. Lake vessels carry millions of passengers and large cargoes annually. There were 13 air lines in 1927, which carried 13,100 passengers. The tourist traffic provides an important source of income.

Finance. The monetary unit is the franc, normally equal to \$0.193. The National Bank has a monopoly of note issue. Banking in Switzerland is highly de-

veloped, particularly since the World War, and Basel and Zürich have become Continental banking centers. As elsewhere, the revenues and expenditures have steadily increased. In 1929 revenue was estimated at \$70,560,000 and expenditure \$70,360,000. The floating debt in 1927 was \$982,800,000, of which more than half was the deficit of the Federal railways.

Government. Switzerland is a democratic union of states. The supreme power rests with the *Bundesversammlung*, a congress consisting of two chambers. The 198 members, 1 to every 20,000 inhabitants, of the National Council are elected for terms of three years by the males over 20. The *Ständerat* consists of two members from each canton, or one from each half canton, elected in some cantons directly, in others by the cantonal parliaments or parishes, for terms of one to four years. The two bodies sit separately, except when they convene to choose the Federal Council and other high Federal officials. The highest administrative body is the Federal Council, *Bundesrat*, of seven members elected by the two houses in joint session. The Federal president is chosen each year the same way from the members of the Federal Council. The president represents the country outwardly, but the actual administration is the Bundesrat as a commission or collegiate body. The LEAGUE OF NATIONS has its headquarters at GENEVA.

SWITZERLAND, HISTORY OF. In 58 B.C. Julius Caesar defeated the Helvetii, a supposedly Celtic people who had lived in northwestern Switzerland and migrated into Gaul, and forced them to return to their former home. In the southeast the Rhaetians, probably of Etruscan origin, were conquered in the reign of Augustus. During the German invasions the Alemanni settled in northeastern and the Burgundians in western Switzerland, while the Rhaetian lands were held for a time by the Ostrogoths. Both the Alemanni and the Burgundians were soon conquered by the Franks, and the latter adopted Christianity toward the end of the 5th century. The Alemanni, however, were not converted until the 7th century, when Irish missionaries founded monasteries and churches among them.

After the disruption of Charlemagne's empire the greater part of Switzerland was held by the Duke of Alemannia, and when in 1033-34 the Burgundian portion passed to the Emperor, all Switzerland was within the Holy Roman Empire. Feudalism took strong hold upon the country, and by the 12th century the Dukes of Zähringen were powerful overlords who encouraged the towns and founded Fribourg, 1178, and Berne, 1191. When their line became extinct, 1218, much of their lands were held by the counts of Kyburg until 1264, when the greater part of them passed to the HOUSE OF HABSBURG, which had already become powerful. Meanwhile the counts of Savoy were gaining a foothold in western Switzerland, several ecclesiastical rulers had become strong, while some of the larger towns had the freedom of the Empire as free imperial cities and were uniting in self-defense.

Swiss Confederation. The beginning of the struggle with the Habsburgs that led to Swiss unity came, however, not from the towns but from the Forest Cantons. Both Uri, 1231, and Schwyz, 1240, had received charters from the Emperor, and had been learning cooperation in political matters before the encroachments of Rudolph of Habsburg at Lucerne threatened to cut off the commerce of the Forest Cantons with the outer world. In face of the common danger a perpetual league for common defense was entered into by Uri, Schwyz and Lower Unterwalden, 1291. In 1315 the Habsburgs attacked the Confederates, *Eidgenossen*, who not only valiantly defended themselves but decisively defeated their foes at Morgarten. The covenant between the Forest Cantons was then renewed in terms that became the foundation of the government of the Swiss Confederation. This document was in German instead of in Latin, as was that of 1291. The results of victory soon became apparent, as one canton after another joined the league: Lucerne, 1332; Zürich, 1351; Glarus and Zug, 1352, and Berne, 1353. The league now numbered eight members, and had spread from the mountains to the plain, as well as westward until it was in contact with French-speaking Savoy.

Another victory was won over the Austrians at Sempach in 1386 and again at Näfels in 1388, until in 1415 Aargau was invaded and taken from the Habsburgs as was the Thurgau by 1461. Meanwhile the league made acquisitions toward the south also, particularly when Uri joined the valley of Urseren and, with it, control of the St. Gotthard Pass. By the Burgundian War, in which the Swiss helped to defeat Charles the Bold, French speaking districts became for the first time a permanent part of the league. Further accessions to the league were Fribourg and Solothurn, 1481; Basel and Schaffhausen, 1501, and Appenzell, 1513, the 13th member. Under Maximilian I the Habsburgs again tried to assert authority over the practically independent Swiss but had to yield and make peace in 1499.

During the 16th century the Swiss became famous as mercenary soldiers, particularly in Italy. The Reformation brought much difficulty to the Confederation, for the Forest Cantons remained Catholic, while Zurich, Berne and other western cantons followed Zwingli, who was killed at Kappel in 1531, while acting as chaplain to the men of Zurich in a war with the Catholics. In 1536 Berne annexed the Pays de Vaud, and in the same year Calvin settled at Geneva, as a result of which that city became the center of Protestantism in Switzerland. The Counter-Reformation strongly affected the country through the influence of Carlo Borromeo, Archbishop of Milan, the coming of the Jesuits to the towns and of the Capuchins to the country folk, and through the residence of a papal nuncio at Lucerne, the center of Swiss Catholicism.

Independence Recognized. The Confederation maintained its neutrality during the THIRTY YEARS' WAR, though the Grisons suffered from severe party

struggles and Swiss Catholics fought as mercenaries with the French against the Habsburgs. The TREATY OF WESTPHALIA formally recognized Swiss independence, which had practically existed since the peace made with Maximilian in 1499. The development of selfish class interests and of aristocratic tendencies in the larger cantons made it easier for the French to occupy the country in 1798. For several years it had to feed the troops which Napoleon held there in readiness for use when needed. With the help of Swiss party leaders he drew up a Constitution, the Act of Mediation, for the Confederation, reestablished in 1803 with 19 cantons, the six new ones being Aargau, Grisons, St. Gall, Thurgau, Ticino and Vaud. Independence was only nominal, however, until it was again recognized by the CONGRESS OF VIENNA, when the Great Powers guaranteed the neutrality and inviolability of Swiss territory. Under a new Federal Pact, Sept. 1814, three new cantons were added, Neuchâtel, Geneva and Valais, thus making 22.

The country soon suffered severely from economic depression, and her weakness in foreign affairs compelled her to join the Holy Alliance, 1817, persecute political refugees and restrict her press, 1823. A number of cantons having liberalized their Constitutions, a vote was carried in the Diet, 1832, for the revision of the Federal Pact. Party feeling ran high, soon developing into a religious quarrel when the liberal cantons demanded ecclesiastical reforms. Recriminations and retaliatory measures led to the so-called War of the SONDERBUND after seven Catholic cantons formed an alliance by that name in 1845. The Sonderbund refused to obey the decision of the Diet, 1847, declaring it unconstitutional and ordering its dissolution. Thereupon Federal forces under Gen. Fufour attacked and defeated its forces. The expenses of the war were imposed upon the allied cantons, the monasteries were suppressed and the Jesuits expelled. The Constitution of 1848 then gave the Confederation a stronger and more efficient government under which the postal and telegraph systems, the customs, the currency and weights and measures were soon unified. Difficulties grew out of the coming of political refugees to Switzerland, and trouble arose with Prussia over her claims to the canton of Neuchâtel; but with the founding of the international Red Cross at Geneva in 1864 the foreign policy of Switzerland began to show the international tendencies that have since characterized it.

In 1874 the Constitution underwent revision that gave the Federal State more powers and introduced the optional referendum in legislation. The Government began to purchase railways in 1898 and by 1909 had acquired the five important lines. Increasing commercial and industrial activities were encouraged by setting up a protectionist system and the building of railways and tunnels, of which the St. Gotthard was opened in 1882, the Simplon in 1906 and the Loetschberg in 1913. During the WORLD WAR the Confederation found it difficult to preserve its neutrality because of racial differences in its population

and its need of foodstuffs and raw materials from the Allies and of coal from Germany. In consequence she was at heavy expense for the maintenance of a military force under arms. A general strike of a threatening political nature occurred just as the war was ending. She joined the LEAGUE OF NATIONS whose headquarters were located in Geneva and has been well represented there, particularly by M. Motta. The brief period of prosperity that followed the war was soon succeeded by grave economic distress that only slowly improved. A. L. L.

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SWORD, a general designation for the cutting or thrusting weapon carried as a side arm by military or civil persons of special rank. Special designations are saber, rapier, broadsword, cutlass, scimitar and shortsword. See SMALL ARMS.

SWORD FERN, the common name for a genus (*Nephrolepis*) of handsome tropical and subtropical plants of the true-fern family. There are about 12 species, some terrestrial and others epiphytic, comprising widely grown house and conservatory ferns, the most popular of which is the well known Boston FERN.

SWORDFISH (*Xiphias gladius*), a powerful fish noted for its vicious habits and great destruction of other fishes, such as mackerel, menhaden, and bluefish. It is found in the North Atlantic particularly along the New England coast, in the Mediterranean, and occasionally in the Pacific. The swordfish is related to the mackerel and resembles it somewhat with its smooth, elongate, rounded body from 7 to 10 ft. long, and its strong, forked tail. Other features are the high dorsal fin, and the so-called sword, which is a prolongation of the snout. Using this flattened bar, or sword as a weapon, the swordfish has pierced through wooden boats, and rising from under a school of fishes slashes its victims right and left and then devours what it wants. Fishermen find it excellent sport to harpoon swordfish in the summer when they come near shore in large numbers. They swim close to the surface and are sighted by the appearance of the dorsal fin above the water. Their flesh is a highly valued food. The spear-fishes (*Tetrapturus* or *Makaira*) and sail-fishes (*Istiophorus*) have spear-like prolongations and attack in the same way as the swordfish. See ANGLING.

In 1929 the commercial catch of swordfish in United States waters amounted to 7,086,000 lbs. with a value of \$1,031,000, nine-tenths of which was taken off the coast of New England.

SWOYERSVILLE, a borough of Luzerne Co., northeastern Pennsylvania, situated 3 mi. north of Wilkes-Barre, and connected with that city by trolleys and buses. Anthracite coal mining is the chief local industry. Pop. 1920, 6,876; 1930, 9,133.

SYBARIS, a celebrated Greek city of ancient Italy situated on the west shore of the Gulf of Tarentum

at the confluence of the rivers Crathis and Sybaris. Founded about 720 B.C. by Achaeans and Troezenians, the city soon became known for its great wealth and luxury. Sybaris reached its zenith in the 6th century B.C.; 25 towns were under its dominion and it had founded colonies of its own as far as the Tyrrhenian Sea. But the Troezenians were exiled by the Achaeans, and the former, allying themselves with the Crotonians, captured Sybaris and destroyed it by turning the waters of the Crathis over the site. Thurii, near Sybaris, received the descendants of the homeless population. The words *Sybarite* and *Sybaritic* have their origin in this city and its pleasure-loving inhabitants.

SYBEL, HENRICH VON (1817-95), German historian, was born at Düsseldorf, Aug. 1, 1817. He was a student of LEOPOLD VON RANKE, and began teaching at Bonn in 1841, becoming professor in 1844. From Bonn he was called to the professorship of history at Marburg in 1846. Ten years later he went to the University of Munich and in 1861 to Bonn a professor of modern history. From 1862-64 he was deputy in the Prussian Diet, opposing Bismarck; in 1867 a member of the Constitutional Assembly, and again a deputy in the Diet from 1874-80 as a National-Leaue. In 1875 he became director of the Prussian archives at Berlin. Sybel died at Marburg, Aug. 1, 1895. His earliest work was a history of the First Crusade which appeared in 1844. Later he turned his attention exclusively to modern history publishing the *History of the Revolutionary Age 1789-1800* and *The Founding of the German Empire Under William I*, besides writing many historical articles and founding and editing the *Historische Zeitschrift*.



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

CALIFORNIA SYCAMORE

Pistil, stamen and branchlet with fruits

SYCAMORE, the name given in the United States to the native species of *Platanus*, the Old World species of which are commonly known as plane or PLANE-TREE. The common sycamore (*P. occidentalis* called also buttonwood, is the most massive deciduous

leaved tree of eastern North America. The tree grows sometimes 170 ft. high, with a trunk 11 ft. in diameter above the enlarged base. It bears reddish-brown bark, which exfoliates in large thin scales exposing irregular patches of the whitish inner bark; broad, slightly lobed leaves, and globular fruit heads suspended on slender stalks. The hard, heavy but not strong, reddish-brown wood, prized for butcher's blocks, furniture and interior finish, is sparingly cut for lumber.

The smaller California sycamore (*P. racemosa*) with three- to five-lobed leaves, grows abundantly in valleys from the upper Sacramento to Lower California. The similar Mexican sycamore (*P. Wrightii*), with very deeply lobed leaves, occurs in Arizona, New Mexico and Sonora.

SYDENHAM, THOMAS (1624-89), English physician, born Sept. 10, 1624, Wynford Eagle, Dorset. He received the degree of M.B. at Oxford in 1648. Following service in the army, he continued his researches at Montpellier. In 1663 he passed examinations of the College of Physicians and was thereby permitted to practice medicine in London. In 1676 he became physician at Cambridge. He died in London, Dec. 29, 1689. He was a reviver of the Hippocratic idea that observation should have precedence over theory. He has been correctly called the founder of modern clinical medicine and his accounts of malaria, plague, smallpox, hysteria and gout are clear and concise. He must also be credited for the first description of scarlatina and for the modern definition of cholera. M. F.

SYDENHAM-HARRISON RESOLUTIONS, in Canadian history, resolutions enacted by the first Union Parliament which in effect recognized the principle of responsible government. Baron Sydenham as governor of Canada steadily opposed all demands for diminution of the power of his office, and exerted a vigorous personal control. But when on Sept. 3, 1841, ROBERT BALDWIN in Parliament moved a series of resolutions recognizing cabinet responsibility in colonial government, Sydenham chose to avert conflict with the liberals and probably certain defeat by drawing up counter-resolutions embodying vital concessions. These four resolutions, introduced in the assembly by Samuel Bealey Harrison and adopted, recognized the right of the people "of having a provincial parliament for the protection of their liberties, for the exercise of a constitutional influence over the executive departments . . . and for legislation upon all matters of internal government," and acknowledged that "the chief advisers of the representatives of the Sovereign constituting a provincial administration under him, ought to be possessed of the confidence of the representatives of the people. . . ."

SYDNEY, the largest and oldest city in Australia and the capital of NEW SOUTH WALES, situated on the shores of Port Jackson, a deep inlet accessible from the Pacific Ocean by a passage about a mile wide between North and South Head. The harbor, with an embayed water frontage of 190 mi., is one

of the finest in the world, and extends inland from the north and south "Heads" for 13 mi. Large wharves with excellent shipping facilities are close to the business center of Sydney.

In striking contrast to the narrow and irregular streets of the city itself are the modern planning methods adopted in the suburbs. The principal suburbs are Paddington, Darlington, Waverley and Randwick, with its famous race course, on the east; on the south, Redfern, Waterloo, Botany, Rochdale and Kogarah; on the west, Petersham, Newtown, Ashfield, Burwood and Canterbury; along the harbor, Balmain, Drummoyne and Gladesville; on the north shores of Port Jackson, the residential districts of Mosman, North Sydney and Chatswood; and still farther from the city, Manly, lying on the ocean front.

The arch bridge over Sydney Harbor, connecting the city with the north shore, was completed in 1931. It has a total length of 3,770 ft., a span of 1,675 ft. and a 170 ft. headway for passing vessels. It carries a roadway, two sidewalks and four lines of railway, and cost approximately \$30,000,000. Large sums have been spent for the construction of underground railways through the city. The first such line was opened for traffic in 1926.

There are a number of fine buildings in Sydney. The university, with six affiliated colleges, Anglican, Roman Catholic, Presbyterian, Wesleyan, Women's and Teachers', is a good specimen of Gothic architecture. There are also government buildings, the National Art Gallery, museums and two cathedrals. Among the many beautiful parks and recreation centers are the Botanical Gardens, the Domain, Hyde Park, Moore Park, Centennial Park, and Sydney Cricket Ground. The National Park outside the metropolitan area measures 33,800 acres.

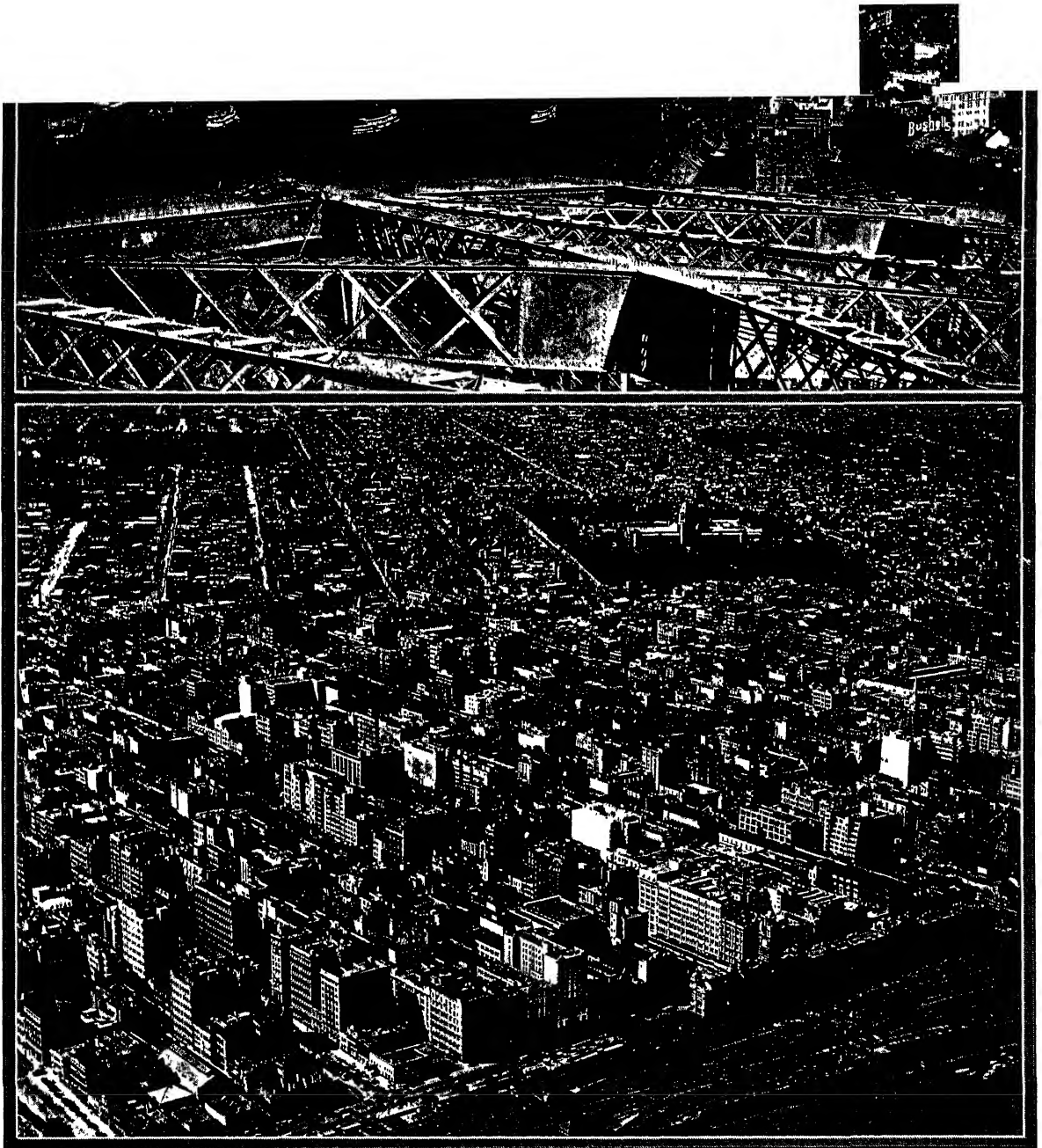
The chief manufactures are clothing, metal and machinery; and there is an extensive shipbuilding industry. Sydney is also one of the largest wool-selling centers in the world.

The city was founded in 1788 by Captain Phillip, who was sent by the British government to select a site for a colony. The population has increased rapidly: in 1861 it was 97,061; in 1901, 487,932; in 1921, 906,103; and in 1929, with the inclusion of the suburbs it had reached 1,238,660, or about 50% of the total population of New South Wales.

SYDNEY, a chief city of Cape Breton Co., Nova Scotia, Canada, situated at the head of an excellent harbor, about 200 mi. northeast of Halifax. The eastern terminus of the Canadian National Railway, it is a manufacturing city in a coal mining district. There are foundries, steel works, creosote plants, planing mills and lime kilns. A pleasantly situated city, having a large coastal ship communication, it is popular as a summer resort. It is the port of the large coal and iron and steel companies. Pop. 1921, 22,545; 1931, 23,089.

SYDNEY, UNIVERSITY OF, an institution for men and women, founded at Sydney, Australia, in 1850. Its development has been largely due to pri-

SYDNEY AND MELBOURNE



COURTESY OF THE AUSTRALIAN NATIONAL TRAVEL ASSN.

FOREMOST AUSTRALIAN CITIES

1. Sydney Harbor with the city in the background, viewed from the new steel arch bridge opened in 1932.
2. Melbourne, showing the broad symmetrical streets and modern buildings of this great city of over 1,000,000 people.

vate endowments, although the state also contributes to its support. The university maintains schools of Arts, Law, Medicine, Science, Engineering, Dentistry, Veterinary Science, Agriculture, Economy and Architecture. The Commonwealth School of Public Health and Tropical Medicine, financed by the Commonwealth Health Department, is directly controlled by the university and the faculty of medicine. The library, endowed in 1880 by T. Fisher, contains 180,000 volumes. The Nicholson collection of Egypt, Greek, Roman and Medieval antiquities includes 4,000 specimens. In 1931-32 there were 3,100 students. The chancellor of the university was the Hon. Sir William Portus Cullen.

SYDNEY CARTON, a character in Dickens's *Tale of Two Cities*. He loves Lucie Manette. His appearance is not unlike that of Charles Darney for whom he substitutes himself when the latter is about to be executed in the French Revolution. His motive is the love which Lucie Manette holds for Darney.

SYDNEY MINES, a town in Cape Breton Co., Nova Scotia, Canada, situated on Sydney Harbor, about 8 mi. northwest of Sydney and 210 mi. northeast of Halifax. Coal mining is the leading industry. The town, with its brick, single story miners' houses, presents a picturesque appearance. East of the town is the receiving station of a cable company. Pop. 1921, 8,327; 1931, 7,759.

SYENITE, a group of IGNEOUS ROCKS somewhat like the GRANITES except that they contain little or no QUARTZ. They are coarse to fine granular in texture, the constituent minerals, readily visible, being ORTHOCLASE, HORNBLende, MICA, and PYROXENE. In color, these rocks are usually white to pink or red, but yellow, and especially gray varieties are found. The syenites are not of very frequent occurrence.

Nephelite syenites contain NEPHELITE and often sodalite. Some syenites carry CORUNDUM. These rocks are found in Germany, in the Alps, in the New England states, in Arkansas and in Montana. Like the granites they are used for building purposes. See also PETROLOGY; PHONOLITE.

SYLLOGISM, a form of argument in which a conclusion is drawn from two premises connected by a middle term. It is the classical deductive form of reasoning developed by Aristotle to such perfection that its rules and structure have not been radically changed throughout the centuries.

Structurally the syllogism consists of three parts, two premises and a conclusion. The premises are known as the major and minor according as they contain either the major or the minor term. A syllogism must also contain three terms, and three only. These are the major, the minor and the middle terms. The key to the analysis of any syllogism is the conclusion. The major term is found in the predicate of the conclusion, the minor term constituting its subject. The middle term is found in both premises but is not contained in the conclusion.

As an example of the perfect syllogism it would be well to quote the old and well-known one because

of its simplicity and clear illustration of the relationship between the terms and propositions composing it. It is as follows: "All men are mortal. Socrates is a man. Therefore, Socrates is mortal." Here "Socrates is mortal" is the conclusion. Beginning with the predicate of the conclusion, "is mortal" we discover the major term. It is found in the predicate of the first proposition, thus making this the major premise. Socrates being the subject of the conclusion, the second proposition is the minor, for it constitutes the subject of this proposition. "Man," the middle term, is found in both premises but not in the conclusion.

SYLVANITE, a valuable but rare ORE of gold and silver, consisting of a compound of these metals and tellurium. It is a metallic white to pale yellow, crystallizing in the MONOCLINIC SYSTEM. See also TELLURIDE; ORE DEPOSITS.

SYLVESTER, name of three popes and an antipope. St. Sylvester I, 314-335, is said to have crowned Emperor Constantine the Great. Sylvester II, 999-1003, raised to the papacy by Otto III, was a prodigy of learning and the most remarkable man of his generation. Emperor and Pope were to reconstruct the world, but the Pope was the predominating influence, as he was studiously building up the interests of the Church, and outlived the young dreamer and Emperor. Sylvester III, set up against Benedict IX, was deposed in 1046. Sylvester IV was antipope to Paschal II in 1105.

SYLVESTRINES, CONGREGATION OF, one of the lesser monastic orders, founded on the Benedictine Rule. St. Sylvester Gozzolini built a monastery for his disciples on Monte Fano near Fabriano in 1231. Innocent IV approved the Congregation in 1247, and by 1267 it had 11 establishments. There are now eight in Italy and two missions in Kandy, Ceylon, and the United States (Diocese of Wichita); religious total 75. The present Constitutions were approved by Gregory XVI in 1838. Convents of Sylvestrine nuns no longer exist.

SYMBIOSIS, the intimate living together of two or more different kinds of organisms. Some authorities, especially in zoology, make symbiosis refer only to mutualistic relations in which both sides have benefit. There is every degree of association, from forms that have only the vaguest influence on each other, such as the various elements of an ecological association, to the lichens, where the two plants are so completely intermingled that it needs microscopic methods to distinguish one from the other. In another way, the mutual dependence may vary to any extent, and cases are common where one member may get obvious benefit from the partnership, while the other gets little if any, and finally where one partner lives at the actual expense of the other (see PARASITISM). There are all gradations between mutualistic symbiosis and parasitism, or antagonistic symbiosis.

The lichens are perhaps the most famous examples of symbiosis. In this case a fungus and an alga are very closely associated. The fungus is obviously

wholly dependent on the alga for its supply of carbon, for only the alga has green chlorophyll-bearing cells capable of forming carbon compounds from carbon dioxide. On the other hand the alga gets little obvious advantage from the fungus, perhaps mechanical support and some protection, which it might get about as well from dead matter. Possibly the fungus also provides it with some nutritive elements, but it has been found possible to grow the alga independently of the lichen plant, and it has even been supposed that the alga in some instances is the same species as a free-living form. Another famous example of symbiosis is seen in root-nodules on many legumes and other plants, the nodules containing bacteria which are capable of fixing free nitrogen and converting it into organic substances which the higher plant can utilize. Here again while the plant gains some obvious benefit in a store of food which it would otherwise be unable to get, the bacterium does not have so obvious a benefit from the host plant, and if the size relationship of the two were interchanged one would be tempted to speak of parasitism.

In the animal kingdom also are similar examples. In many of the close associations in ants' nests, for instance, the ant seems to get only a secretion from the symbiont, which is probably of little or no real use to it, while the symbiont, or perhaps parasite, gets its whole living, and protection as well, from the ant. Between ants and plant-lice the partnership appears to be more even, as the honey-dew which the ants get from the lice is a real food supply, while the ants effectively protect the lice from many of their enemies.

A border line case of another type is found in the association between two different individuals of a single species. In this instance one hesitates to use the term symbiosis, but the essential nature is the same. Striking examples are the worm *Bonellia* and the fish *Cerattias*. The male is completely dependent on the female for its food supply, and the female only benefits by the fertilization of her eggs. One may also place here such cases as the siphonophorous jelly-fish; individuals of various kinds, eating, storage, protective, reproductive, are loosely associated to make an organism, each individual dependent on the others for some of the essential functions. This is not true mutualistic symbiosis, but is almost an equivalent.

W. T. M. F.

SYMMACHUS, ST., Pope, 498-514, was declared the legitimate pope by a council held in Rome in 502.

Laurentius was antipope to Symmachus.

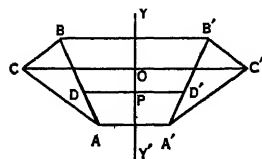


FIGURE SYMMETRIC WITH RESPECT TO AXIS YY'

SYMMETRIC FIGURES, figures which have the same shape and size, but with the elements differently arranged. They may be symmetric with respect to a center, as described in the article on similar figures; or symmetric with respect to an axis, as shown in this figure, in which YY' is the axis of symmetry, with

$OC = OC'$, $PB = PB'$ and so for all other pairs of points equidistant from the axis. The opened wings of a butterfly furnish an interesting illustration. In the same way, two solids may be similar with respect to a plane of symmetry, like an object and its reflection in a mirror. See SIMILAR FIGURES.

SYMONDS, JOHN ADDINGTON (1840-93), English critic, was born at Bristol, Oct. 5, 1840. He studied at Oxford until ill health compelled him to go abroad. He returned to England, lecturing there, but in 1877 was again forced to go abroad and settled permanently at Davos Platz, Switzerland. From 1875-86 Symonds was engaged on his *Renaissance in Italy*, the work by which he remains best known. He also wrote biographies of Shelley, Sir Philip Sidney, Ben Jonson and Michelangelo, and translated the *Autobiography of Benvenuto Cellini*. Symonds died at Rome, Apr. 19, 1893.

SYMONS, ARTHUR (1865-), English writer, was born in Wales, Feb. 28, 1865, and privately educated. As both poet and critic he was strongly influenced by French models and conspicuously allied himself with the esthetes forming the *Yellow Book* group. (See YELLOW BOOK.) His verse includes *Days and Nights*, *Silhouettes*, *London Nights*, and *Jezebel Mort*, 1931. Among his essays and critical works are *Studies in Two Literatures*, 1897, *Cities*, *Spiritual Adventures*, *Studies in Elizabethan Drama*, *Charles Baudelaire*, 1921, and *A Study of Thomas Hardy*, 1927. Symons also translated several works from the Italian and French.

SYMONS, GEORGE GARDNER (1865-1930), American landscape painter, was born at Chicago, Ill., in 1865. He studied at the Art Institute, Chicago, and in Paris, Munich and London. He became a member of the National Academy in 1911. Symons's works include *The Opalescent River* in the Metropolitan Museum, New York; *Snow Clouds*, Corcoran Gallery, Washington; *Sorrow*, Cincinnati Museum; *The Winter Sun*, Art Institute, Chicago; and *Through Wooded Hills*, Art Association, Dallas, Tex. The artist died in New York City, Jan. 12, 1930.

SYMPATHETIC NERVOUS SYSTEM. The nerves of the organs of the chest (heart, lungs and respiratory tubes); of the abdomen (stomach, intestines, pancreas, liver, spleen, kidneys); of the pelvis (bladder, rectum, female organs); of the sebaceous and sweat glands; of the organs of the internal secretion (thyroid, pituitary, adrenals); of the blood vessels—in short, of the structures whose activity is not dependent upon our will, are supplied by the sympathetic nervous system. Other names used are involuntary, vegetative, autonomic (self-controlling) or vital, as this system supervises organs which are essential to life. This system differs from the cerebrospinal nervous system, which controls voluntary movements and sensations such as smell, hearing and taste.

The two systems differ not only in their function, but also in their structure. Supplying, as they do, a great number of organs, the nerve cells of the sym-

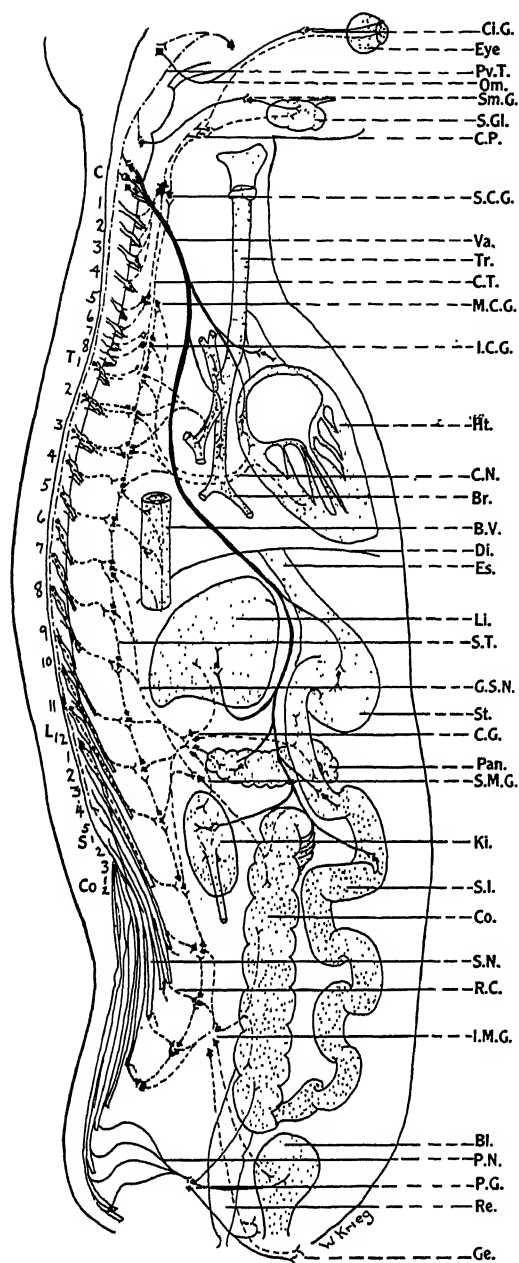
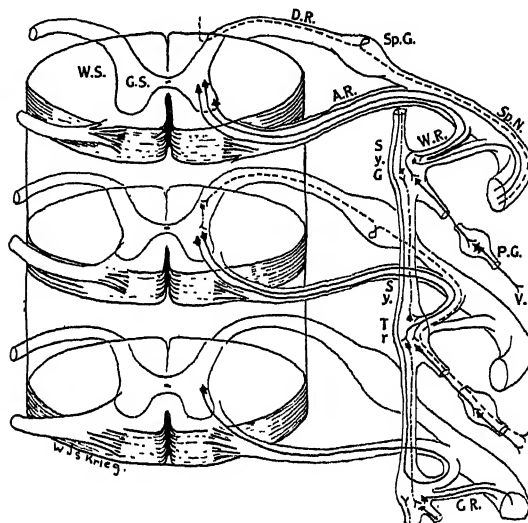


FIG. 1. SYMPATHETIC NERVOUS SYSTEM

Diagram to show distribution of neurones of autonomic (motor sympathetic) nervous system, and the interrelation of its two component but opposing divisions: The sympathetic neurones (broken lines), and the parasympathetic neurones (solid lines).

Bl., bladder; Br., bronchi; B.V., blood vessel, represented by descending aorta; C.G., celiac ganglion; Cl.G., ciliary gland; Co., colon; C.N., cardiac nerves; C.P., plexus around carotid artery; C.T., cervical sympathetic trunk; Di., diaphragm; Es., esophagus; Eye, eye; Ge., terminations in generative organs; G.S.N., great splanchnic nerve; Ht., heart; I.C.G., inferior cervical ganglion; I.M.G., inferior mesenteric ganglion; Ki., kidney; Li., liver; M.C.G., middle cervical ganglion; Om., oculomotor fibers; Pan., pancreas; P.G., pelvic ganglion; P.N., pelvic nerve; Pv.T., periventricular tract; R.C., white ramus communicans; Re., rectum; S.C.G., superior cervical ganglion; S.Gl., submaxillary ganglion; S.M.G., superior mesenteric ganglion; S.I., small intestine; Sm.G., submaxillary ganglion; S.N., splanchnic nerve; S.T., thoracic sympathetic trunk; Tr., trachea; Va., vagus nerve

pathetic nervous system are not centralized as are those of the cerebrospinal nervous system. The cells are grouped together into nodes, situated within the abdomen and the chest, along either side of the vertebral column. Each node possesses a connective tissue capsule. Connected with each other by means of nerve fibers, they form a longitudinal chain extending parallel to the major portion of the vertebral column. The chain of nodes thus formed is called vertebral, or better, paravertebral. The nodes or ganglia receive thick nerve fibers from the spinal cord and give off thinner ones to the peripheral nerves and to the numerous organs mentioned. Just before they reach any of the organs (the intestines, for instance), the fibers form a dense network, resembling thick skeins



2. STEREO-DIAGRAM TO SHOW RELATION OF NEURONS OF SYMPATHETIC AND CEREBROSPINAL NERVOUS SYSTEMS

..... sensory neurons
— motor neurons
- - - - - communicating neurons

A.R., anterior root; D.R., dorsal root; G.R., grey ramus; G.S., grey substance of spinal cord; P.G., peripheral sympathetic ganglion; Sp.G., spinal ganglion; Sp.N., spinal nerve; Sy.G., ganglion of sympathetic trunk; Sy.Tr., sympathetic trunk; W.R., white ramus; V, viscus containing termination of peripheral sympathetic neuron; W.S., white substance of spinal cord

of nerve fibers, called plexuses. In these are enmeshed other nerve cells, and from them single nerves emanate for final supply of a given organ. The latter (for instance, the intestines), sends its sensations (pain, when diseased) to its plexus, through this to the paravertebral node, from the latter to the spinal cord, and from here to the brain. The sympathetic nervous system is thus ultimately connected with the brain. It is dominated by it, like the processes of feeling, acting and thinking, and is not thus an altogether independent, autonomous system.

Some instances of the interdependence of the cerebrospinal (voluntary) and sympathetic (involuntary) systems are furnished by cases in which mental anxiety and grief are associated with loss of desire for nourishment. In emotional states, the color of the face may be pale; the face is terror-stricken, or it may

be red, animated, confused, when one is embarrassed, excited or suddenly inconvenienced. A feeling of choking in the throat, or an imperative desire to void urine or palpitation of the heart, are felt when one is under undue stress. Other instances of the workings of the sympathetic nervous system are furnished by experimental data. When the sympathetic nerve of a cat is divided in the neck and stimulated by an electric current, the result is raising of the hair of the front parts of the head. It is in these regions that bristling occurs when the animal is angered (Sherington).

It would probably be incompatible with the comforts of life, if the activities of the sympathetic nervous system were not kept within certain limits. Such an inhibitory function has been provided by nature in another type of sympathetic nervous system called parasympathetic. Like the former, it is not subject to our will, but has an entirely reverse function. For instance, the excessive activity of the heart stimulated by the sympathetic nerve may be rendered milder by a stimulation of a parasympathetic component, passing down through the vagus or pneumogastric nerve, which slows the heart beats down considerably. The existence of both systems is evidently necessary for the continuous and proper action of the heart. A similar relation obtains within the intestines, stomach, pupils of the eye and other organs. It is said that the parasympathetic nervous system is antagonistic to that of the sympathetic. Such conditions may be brought on by the action of drugs. Nicotin, for instance, paralyzes the sympathetic nerve, while atropin paralyzes the parasympathetic. Adrenalin and cocain stimulate the former, pilocarpin and morphine stimulate the parasympathetic. Pilocarpin causes excessive sweating and increased salivation, atropin reduces the secretion of saliva and diminishes perspiration. In normal conditions there is an interaction between these two systems, effected by means of a refined mechanism, called reflexes. The workings of such a complex reflex mechanism must be extremely well regulated, if one bears in mind the myriads of nerve cells and nerve fibers emanating from the latter and controlling the activity of so many organs, blood vessels, glands, muscles and other tissues, all connected with one another by nerve fibers and never ceasing or failing in their work during the entire duration of life. Aside from the remarkable functional adjustment of the sympathetic and parasympathetic nerve fibers, there are other features which deserve mention.

First there is lack of fatigue. An ordinary, so-called cerebrospinal nerve becomes fatigued or exhausted from work. It shows, for instance, in the extremities after prolonged walking or exercising. The sympathetic and parasympathetic nervous systems do not know fatigue. Stimulations, for instance, by electric currents bring no signs of exhaustion. Another feature is the rhythmic activity, as best shown in the heart, the intestines and blood vessels. Such a rhythmic action can well be followed up in the skin. The peripheral nerves, extending to the muscles, skin,

mucous membranes, contain a number of sympathetic nerve fibers. They are destined mainly for the blood vessels. It is claimed that the latter become contracted from the action of one set of fibers (nerve constrictors) and dilated from the action of another set of fibers (vasodilators). While the existence of such a double set of vascular nerve fibers is still doubtful, the rhythmic action of the blood vessels and of the heart, is one of the remarkable adaptation mechanisms necessary for the regulation of circulation, heat and other conditions.

These few examples give some idea of the function of the sympathetic nervous system, its significance and value. See also SPINAL CORD. For injuries to the sympathetic nerves, see NEUROSURGERY: Sympathetic Nerves. G. B. H.

SYMPATHY, a "feeling with" process, or the putting of oneself in the place of another. Sympathy has been regarded as instinctive but this position is becoming less and less acceptable. McDougall discusses sympathy under what he calls "the sympathetic induction of the emotions," while Allport makes a much better case for it as a form of conditioned response.

When one person sympathizes with another there is released in the first, either as a part of his experience or as the result of imagination, an attitude that enables him to enter into the situation of the other. Without this experience, real or imaginary, he would find it quite impossible to enter into a sympathetic relation. He thinks he sympathizes with another, when it may be only himself for whom he feels the sympathy. He projects himself into the situation and then feels sorry for himself in such a situation. That this is true may be illustrated by the fact that sympathy deepens in proportion as the self has undergone a like experience.

SYMPHONIC POEM, a fantasy-like composition, in one movement, for orchestra. It is commonly an example of PROGRAM MUSIC although it does not necessarily make attempts at description. To FRANZ LISZT (1811-86) is ascribed the invention of this form which he named *Symphonische Dichtung*, a dozen examples of which he created, notably *Tasso*, *Faust*, and the *Preludes*. Less pretentious in scope than the symphony, and less formal in structure than the concert overture, the symphonic poem, known also as an orchestral tone-poem, is a particularly happy medium for the musical rhapsodist who is not interested in sustained flights of the imagination, and who rebels against the rigid patterns of the classical manner. The chief modern composer using this form has been RICHARD STRAUSS (1864-), whose seven symphonic poems, *Don Juan*, *Macbeth*, *Tod und Verklärung*, *Till Eulenspiegel*, *Also Sprach Zarathustra*, *Don Quixote*, and *Ein Heldenleben*, represent not only some of their creator's most individual music but also orchestral wizardry of a high technical order.

SYMPHONY, in music, a major composition for orchestra. Springing from the Greek word *symphonia*, denoting concord in sound, the term first

appears as the title for a musical composition in the 17th century. Undergoing various changes, sometimes associated with vocal works with instrumental accompaniment, the symphony first crystallized into a definite musical form with FRANZ JOSEF HAYDN (1732-1809) and Wolfgang Amadeus Mozart (1756-91). In the hands of LUDWIG VAN BEETHOVEN (1770-1827) the symphony reached an inspired perfection of classical style and form that has not since been surpassed. This form of music is a composition for orchestra in four contrasting movements, each of which is individual and with a definite finish, yet so constructed as to fit sympathetically into the general pattern. This may be accomplished by either using thematic material from the preceding movement in a new guise, according to the imagination or craftsmanship of the composer, or by displaying, throughout, his distinctive style in various moods, and thus tying the work together as a more or less connected story with a few short pauses between the several movements.

Technically, the symphony is an elaborated orchestral SONATA, the symphony being to the sonata as the novel is to the short story. Its first movement starts out either briskly or retrospectively but it then hurries on to the development of its two, or more, themes. The second movement, in direct contrast to the first, is customarily a slow and thoughtful one, usually featuring the melodic gift of the composer. The favorite third movement with practically all serious composers is in the dance, RONDO or SCHERZO form, flirtatious or with tender gayety, but at its finish, or CODA, it frequently returns without loss of tempo to the thoughtful matter in hand. In these respects, the Sixth Symphony or *Pathetic* by PETER TSCHAIKOWSKY (1840-93) is an admirable example, as are most of BEETHOVEN's nine symphonies and the *B Flat Symphony* by ROBERT SCHUMANN (1810-56). The last movement is again brisk but usually of a noble character, being the final emphasis of the composer's idea in general.

While practically all the German and Austrian masters excelled in this form, the major composers of other nations have written symphonies, as, for example: Edward Elgar (1867-) and Ralph Vaughan-Williams (1872-) of England; César Franck (1822-90) and Camille Saint-Saëns (1835-1921) of France; Niels Gade (1817-90) of Denmark; Johan Sibelius (1865-) of Finland; and Tchaikowsky, Alexander Glazunov (1865-) and A. N. Scriabin (1871-1915) of Russia; and in the United States, John Knowles Paine (1839-1906) and Henry Kimball Hadley (1871-). T. S.

BIBLIOGRAPHY.—G. Grove, *Beethoven and His Nine Symphonies*, 1896; P. H. Gaëpp, *Symphonies and Their Meanings*, 1905; J. F. Porte, *Stories of Famous Symphonies and Analysis*, 1927.

SYNÆSTHESIA, a phenomenon of concomitant sensation in which one type of sensation suggests another. Seeing sounds and hearing colors are examples of synæsthesia. A sense organ other than the one stimulated responds in conjunction with the usual

receptor. Colored hearing and auditory vision are sometimes regarded as idiosyncrasies, and may be produced by conditioning.

SYNAGOGUE, a term applied to a Jewish house of worship. Among Reform Jews, the synagogue is generally called TEMPLE, and is of somewhat different interior arrangement and external appearance. The Hebrew words for synagogue are *beth hakeneseth*, or house of meeting, and *beth tefillah*, or house of prayer. Among the Orthodox it is frequently called *Shul*, from the German word *Schule*, or school, for the vestry or lower rooms of synagogues were generally used for purposes of study as well. The synagogue at an early date took the place of the Temple at Jerusalem, soon after the destruction of the Second Temple in 70 A.D. Synagogue was the word used in the Hellenistic period of Jewish history, especially at Alexandria, Egypt, during the 1st century B.C. and the 1st century A.D., for a coming together or gathering together of a number of people in assembly, also for an assembly held for communal or religious purposes, i.e. a congregation, which, like synagogue, meant a flocking together, a driving or leading together. Later the word came to designate the place or building where the assembly, or the religious gathering together, took place.

The origin of the synagogue is not definitely known. It is not certain whether or not it existed before the Babylonian Exile, but to judge by the few extant reports it appears possible that there were synagogues in Babylonian Jewish communities during the Exile, and in Palestine after the return. However, there appear to have been many synagogues (see TABERNACLE) in Palestine by 250, and subsequently new houses of worship were erected in every city and country in which any considerable number of Jews came to dwell. These early synagogues were communal houses in the fullest sense of the term, being at once social centers, places of public assembly and houses of worship; in fact all Jewish life centered in and about the synagogue. A. SH.

BIBLIOGRAPHY.—*Jüdisches Lexikon*, vol. 5, cols. 789-809 (with a complete description of the appointments of the synagogue, and illustrations of the various types of synagogues); Kaufmann Kohler, *The Origins of the Synagogue and the Church*, 1930; Israel Abrahams, *Jewish Life in the Middle Ages*, pp. 77-78.

SYNCHRONIC GRAMMAR, study of the phenomena of language as presented at a given period, usually in a specific language, as a grammar of the English of CHAUCER, of the French of MOLIÈRE, of modern German, of American English of the 20th century, etc. The typical school-grammars of modern languages are normally of the synchronic type. Scientifically, wherever accessible data permit, careful studies in synchronic grammar should precede investigations in DIACHRONIC GRAMMAR, which is historical and often comparative in type.

SYNCHRONOUS CONDENSER, the name applied to a synchronous motor (see MOTOR, ELECTRIC) utilized in an electrical power system to improve the POWER FACTOR, i.e., to bring the current more nearly

in phase with the voltage. The current taken by most commercial electrical machines lags the voltage; the current taken by a synchronous condenser leads the voltage. The sum of the two currents (in the ideal case of unity power factor) neither leads nor lags the voltage but is in phase with it. The synchronous condenser, by bringing the current in phase with the voltage, enables the transmission of power at a lower current and voltage. This, in turn, prevents the loss of considerable power in transmission.

SYNCHRONOUS CONVERTER. See CONVERTER, ELECTRIC; ROTARY CONVERTER.

SYNCLINE, a trough-like bend in the beds of a SEDIMENTARY ROCK series. It is the opposite of ANTICLINE. See also GEOSYNCLINE.

SYNCOPATION, in music, the accent given a tone which occupies metrically a relatively weak position. Although this shifting of the normal accent is carried to the point of abuse in such popular music as rag-time and JAZZ, its musical importance should not be slighted, for it is a device to be found in the compositions of all the reputed masters.

SYNCRETISM, a term representing the indiscriminate borrowing of different points of view; a kind of ECLECTICISM. Syncretism is not as careful in its methods of selection as eclecticism and for that reason is still more a term of reproach. In fact the process of syncretism often takes place quite unconsciously. When East and West met at Alexandria a syncretism of cultures is said to have taken place. Christianity is a syncretic religion, representing a fusion of Judaism with Greek philosophy, paganism, and Oriental religions.

SYNDICALISM, an economic philosophy closely allied to ANARCHISM which repudiates CAPITALISM and the political state in favor of a voluntary federation of producers' groups organized in unions or syndicates. This philosophy was basic in the Confederation Générale du Travail (C.G.T.) of France and dominated the Industrial Workers of the World (I.W.W.) of America.

The I.W.W. states its purpose in its preamble. "It is the historic mission of the working class to do away with capitalism. The army of production must be organized not only for the everyday struggle with capitalists but also to carry on production when capitalism shall have been overthrown. By organizing industrially we are forming the structure of the new society within the shell of the old." Specifically the program proposes, for example, that the coal miners organize the production of coal, fixing the rules of operation and federating themselves with the iron and steel workers, the agricultural workers, the railway workers and other groups to coordinate their activities. Each group, however, would retain its autonomy. Distribution would be based on equality.

For the attainment of these ends syndicalists rely upon the GENERAL STRIKE and the strike on the job. All workers are urged to make an injury to one, an injury to all, thus creating a mass solidarity which will bring down the structure of capitalism.

The American government has met the challenge of the I.W.W. by the frequent imprisonment of its leaders and by legislation in a number of states making membership in a syndicalist organization unlawful. Socialists are hostile to the movement, though for a different reason; they feel that the political state can be transformed into an effective governing instrument under worker control. They hold, moreover, that the general strike is not an all-sufficient weapon and that producers' organizations cannot be entrusted with a monopoly of power.

Syndicalism, which is basically Marxian (see KARL MARX) in its doctrines, has in Great Britain been so altered as to form a groundwork for the guild socialist program. C. E. W.

BIBLIOGRAPHY.—P. F. Brissenden, *The I.W.W., A Study in American Syndicalism*; L. Levine, *Syndicalism in France*.

SYNDICATE, an association of financiers or capitalists organized to undertake some commercial or financial enterprise, especially when the organization is temporary. The word is used in particular to indicate a combination of capitalists functioning to raise prices by controlling production. Syndicate is used to denote editorial organizations which supply cartoons, illustrated articles and fiction, such as appear in Sunday supplements of newspapers, to publications throughout the country. These syndicates buy works directly from authors and market them to their several subscribers simultaneously.

SYNECDOCHE, naming a significant part of an object instead of the object itself, an individual instead of a species, a species instead of a genus, or a concrete object in place of an abstraction, etc., e.g., "sails" instead of "ships," "a Homer" instead of "a poet," "sums" instead of "arithmetic," "the ambitions of twenty-one" instead of "the ambitions of a young man," etc. The advantage of the most common form of synecdoche, the use of the part for the whole, is that the attention is focused not upon the object as a whole, but upon some features of it which will help the hearer to be more vividly aware of it or to understand more clearly the significance of the matter under discussion. The reverse operation, although less common, also holds good, i.e., the whole may be used instead of the part, etc. See also METONYMY.

K. D. S.

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SYNGE, JOHN MILLINGTON (1871-1909), Irish dramatist, was born at Newtown Little, near Dublin, Apr. 16, 1871. He was educated at Trinity College, Dublin, and afterwards wandered in Europe. He made annual trips, however, to the primitive Arran Islands, and in 1903 returned to Ireland. W. B. YEATS urged him to write, and the one-act plays, *The Shadow of the Glen* and *Riders to the Sea* were produced in 1903. In 1904 Synge became a director of the Abbey Theatre, Dublin, and produced there *The Well of the Saints*, 1905. *The Playboy of the Western World*, 1907, caused bitter opposition, but made the Abbey famous. Synge died in Dublin,

Mar. 24, 1909, and left a collection of *Poems*, 1909, and the almost completed *Deirdre of the Sorrows*, 1910. See also IRISH THEATER.

SYNOD (Greek *synodos*, assembly), an ecclesiastical term practically synonymous with "council." In the Roman Catholic Church it denotes a group of ecclesiastics convoked by a bishop. When the bishops of the whole Church assemble under the pope the synod is ecumenical; when bishops meet under a metropolitan, it is provincial; and the bishops of a nation form a national or, under some conditions, a general synod. The term is most generally used, however, in connection with the diocesan synods of priests, convoked by their bishop. At these meetings the bishop is the sole legislator and he alone signs the laws that are passed. The Council of Trent required the yearly meeting of diocesan synods, but the New Code allows 10 years to elapse.

At the time of the Reformation the Lutherans abandoned the old synodal system for government by bodies called consistories, the members of which were appointed by the civil authorities. Lutheran groups which broke away from the state inevitably developed synodal systems, and their differing types of organization are reflected in American Lutheranism. In Germany, since 1918 when all churches were made independent of the state, new forms have been and are developing. The Calvinists developed a system of their own, strictly representative, national and mixed, that is, partly composed of laymen. The term "synod" is usually restricted to a body composed of representatives from the presbyteries, which in turn represent a specified number of congregations. From these the synod hears appeals, and by discussion prepares new business for settlement in the General Assembly, which is the supreme governing body of the national church. Wesleyan and other Methodist churches are governed by mixed representative conferences, but the term "synod" is restricted to district meetings. Congregationalists and Baptists do not hold assemblies with legislative power and do not use the term.

In Russia the Holy Synod was established in 1781 as the supreme organ of government of the state church. It was presided over by a lay procurator representing the czar and consisted otherwise of the highest ecclesiastical dignitaries. Members of local and provincial synods were appointed. Since 1917 all churches have been autonomous and members of synods are elected.

In England, up to the 12th century there were national, provincial and diocesan synods. At that time differences between the archbishops of York and Canterbury led to the abandonment of the national council and all ecclesiastical matters were discussed separately in the two provincial synods, commonly called convocations, that of Canterbury being the more important. The Act of Submission of 1533 practically abolished the legislative powers of these bodies, though the Convocation of Canterbury worked with Parliament in legislating for the Church. Prorogued because of differences between the bishops and the Lower House by royal writ in 1717, it was not allowed

to proceed to business until 1861. In 1919, by the passing of the Church of England Assembly Act, members of the Houses of Convocation of both provinces were incorporated into a National Assembly, to which a House of Laymen was added. The convocations continue to act as provincial synods and to vote separately on certain issues. Formerly subject to the Crown, they are now much hampered by Parliament. Local synods are found in each diocese. In the disestablished and daughter churches the synods have more power. The governing body of the Protestant Episcopal Church in the United States, known as the General Convention, has a mixed Lower House.

SYNODIC PERIOD, the interval between two successive CONJUNCTIONS or OPPOSITIONS of a planet or of the moon. In the case of the moon it is called the SYNODIC MONTH, is the time from full moon to full moon and is equal to 29 days, 12 hours and 44 minutes.

SYNTAX, the branch of LINGUISTICS concerned with the relation and arrangement of words in sentences or clauses, representing, together with SEMANTICS, the psychological side of linguistic study. It thus deals solely with the use of words, regardless of their mode of formation or of their composition (cf. INFLECTION; PHONOLOGY). But, on the other hand, it constitutes the source from which the meaning of case, tense is found. Because of its psychological character, precise rules for word-order can scarcely be determined, and as a test of linguistic relationship (see CLASSIFICATION OF LANGUAGES) it is of very minor importance, though from the humanistic point of view it is more interesting than either phonology or morphology.

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SYNTHESIS, the process of building up or combining elements to form wholes, the opposite of analysis. The term is relative, depending on what is synthesised. Thus a synthesis may be sought for a given subject or a given phenomenon. A still more pretentious synthesis is the attempt to bring all knowledge together under a few general principles. Seeking a unity of things, philosophy has often attempted this, as may be witnessed in the great systems. One of these is known as the "Synthetic Philosophy," and HERBERT SPENCER in his *First Principles* tried to find the most general principles underlying such a synthesis of the world's knowledge.

Synthesis in the Hegelian logic consists of the union of opposites into a higher synthesis which includes both, such as the union of being and nonbeing in the form of becoming. Objective and subjective mind are finally united in the Absolute Mind.

SYNTHESIS, CHEMICAL, the name given to the process of building up chemical substances either from the elements directly or by means of intermediate, and usually simpler, compounds, which can

in turn, be synthesized from the elements. It can thus be regarded as the opposite of analysis. In a more restricted sense, the term is now employed for the formation of complex organic substances and as such is of great theoretical importance, as it furnishes definite proof concerning the composition and structure of any synthesized product. Although the methods employed in synthetic chemistry differ greatly from problem to problem, some general rules may be traced which depend upon the characteristic behavior of certain groups of atoms and organic radicals, which may be successively substituted one for the other, thus gradually altering a substance in the desired direction.

SYNTHETIC CHEMICAL PRODUCTS, are such compounds as are made industrially, following the methods of chemical synthesis worked out in the laboratory. They may, or may not have a counterpart in nature, but if a natural substance is available the synthetic product should be able to compete with it commercially. Among the synthetic products at present manufactured may be briefly mentioned the wide variety of **ANILINE** and **NAPHTHALENE DYES** obtained from coal tar and its derivatives, the nitro-cellulose materials, the synthetic **RESINS**, which possess properties far superior to those of resins found in nature. The production of solid fats by hydrogenation of unsaturated, drying-oils has converted into valuable foodstuffs a class of hitherto comparatively worthless substances. Many oils for motor fuel are now obtained by "cracking" heavier, more complex hydrocarbons, while it has become almost possible to synthesize fuel directly on a commercial scale, by uniting carbon and hydrogen. Camphor and menthol, both produced from **TURPENTINE**, indicate the possibilities of such a substance; furthermore the related hemiterpene isoprene, itself capable of synthesis from its elements, via **ACETYLENE**, and the most important intermediary in the synthesis of rubber (*see* **RUBBER**, **SYNTHETIC**), gives a new impetus to such researches.

Such common materials as alcohol, acetic acid, and benzene can be made synthetically, the first step in all three cases being the manufacture of acetylene, from limestone and coke, via calcium carbide. The synthesis of ammonia from hydrogen and atmospheric nitrogen with the aid of a catalyst has dispelled the gloomy outlook which resulted from the threatening exhaustion of the Chilean nitrate beds, and has made available the inexhaustible supply of atmospheric nitrogen for the production of fertilizer. The dye base **ALIZARIN**, formerly extracted from the madder root but now made from **ANTHRACENE**, and indigo, now produced from naphthalene, are two more examples of valuable dyes of vegetable origin which can be made better and cheaper from the all-important coal-tar. Saccharin and salvarsan are two purely "artificial" substances which have risen to eminence in industrial applications and medicinal applications, respectively.

Many other synthetic processes have as yet not ob-

tained commercial application, largely because of the present high cost of production, but in such cases the balance may be easily upset in their favor by a possible exhaustion of the natural supply, or a sudden improvement in their manufacture. Still other products have only theoretical importance as yet, such as the synthetic sugars (*see* **SUGAR**) made by Fischer from phenylhydrazine which have opened up a line of attack upon the large, and important group of carbohydrates. *See also* **YARNS**, **SYNTHETIC**.

W. J. L.

SYPHILIS. *See* **VENEREAL DISEASE**.

Blindness due to. *See* **BLINDNESS**, **MEDICAL ASPECTS OF**.

Effect on newborn. *See* **CHILDREN**, **DISEASES OF: Prenatal Diseases**.

Of lymph nodes. *See* **LYMPHATIC SYSTEM**, **DISEASES OF**.

SYPHONS are required in certain **AQUEDUCTS** at crossings of valleys. Inverted syphons, often just called syphons, are used in such locations, through which the water flows under pressure. Some large syphons are built as tunnels, as the Hudson River crossing for the New York City Water Supply at Storm King Mountain. These are called "pressure tunnels." When pipes are used for syphons, they are essentially like other supply mains.

SYRACUSE (Italian *Siracusa*), a city of southeast Sicily, capital of the province of the same name, situated on a small island artificially connected with the mainland. It is protected by walls, moats and a citadel and has less than one eighth the area of the ancient city which was founded by settlers from Greece before 700 B.C. The city is noted for its harbor. Among the impressive buildings are the medieval cathedral with columns taken from a temple of Minerva, several churches of the 15th century, the archiepiscopal palace, dating from the 16th century, the 17th century Palazzo Comunale, the new museum, and a fine theater. The archeological museum has many treasures from ancient pre-Christian times, and remains of old temples, walls and aqueducts are in the city. There are diversified local industries and a brisk trade, chiefly in olive oil, wine and fruit. Pop. 1931, 50,096.

SYRACUSE, a city of central New York, and the county seat of Onondaga Co., situated at the southern end of Lake Onondaga about midway between Albany and Buffalo on the State Barge Canal. Two railroads, bus and trucking lines provide transportation. The city lies on hilly ground, commanding fine views of the lake, and is surrounded by a fertile agricultural region. It is a distributing point for northern and central New York, and has important manufacturing interests. The original development and prosperity of the city was based on the salt springs, which the state acquired in 1795. In 1797, the state started to lease the salt lands on a royalty basis. This started a community which was named Syracuse in 1820 and incorporated as a village in 1825. For nearly a century Syracuse remained the

SYRIA



COURTESY SYRIAN WORLD

VIEWS IN SYRIA AND LEBANON

1. The principal bazaar at Aleppo, northwestern Syria.
2. The ruined citadel at Aleppo, part of which dates from 605. Arabic style. 3. Road in the State of Lebanon leading to Brummana, a resort frequented by Beirut residents.

4. A stone villa in one of the villages on the slope of Lebanon in southern Syria. 5. Inner court of the palace of the Emir Beshir at Beit ed-Din in Lebanon. 6. Interior of the mosaic doorway of the palace at Beit ed-Din.

country's principal source of supply for salt. Representatives of this industry were most active in demanding the development of the Erie canal, the first section of which opened in 1820 and ran through Syracuse. In 1929 the diversified manufacturing industries produced a total output worth about \$181,000,000, with typewriters, automobiles, electrical apparatus, shoes and tool steel among the most important products. In 1929, 277 wholesalers proper distributed an aggregate of \$84,671,569 worth of merchandise. During the same year the 3,128 retail stores, which did a total business of \$138,065,947, gave full-time employment to 12,011 people. There are limestone quarries, truck, dairy and grain farms in the region. Syracuse University is located here. The city operates under a mayor-and-council form of government. Syracuse was originally settled in 1788 and chartered as a city in 1847. Pop. 1920, 171,717; 1930, 209,326.

SYRACUSE, UNIVERSITY OF, a coeducational institution located at Syracuse, N.Y. Though founded, in 1870, by the Methodist Episcopal Church, it is non-sectarian and, with the exception of the State College of Forestry, privately controlled. The Liberal Arts department of the university was a continuation of Genesee College, established at Lima, N.Y., in 1849. The New York State College of Forestry became a branch of the university in 1911. The institution had productive funds in 1931 amounting to \$5,058,347. The library contained 199,115 volumes. In 1931-32 there were 5,430 students, and a faculty of 550, headed by Chancellor CHARLES W. FLINT.

SYRIA, formerly a province of Asiatic Turkey is now an independent state under French mandate. The mandate was assigned to France by decision of the Supreme Council of the Allied Powers on Apr. 25, 1920 and was confirmed by the League of Nations July 24, 1922. Syria as constituted by this mandate is bordered by Turkey on the north, by the Mediterranean on the west, by Palestine on the south and by Mesopotamia on the east. The original territories of DAMASCUS and Aleppo now constitute the Republic of Syria with the capital at Damascus. The Republic of Syria is only a part of mandated Syria, the other three territories being the Republic of Greater Lebanon with its capital at Beirut, the Government of Latakia with its capital at Latakia, and the Government of Jebel Druze with its capital at El Suweda. The total area of mandated Syria is 60,000 sq. mi. and its population according to the 1929 census was 2,831,622. Of this population Syria proper contains 1,696,638, mostly of Arabic origin; Lebanon contains 862,618 of whom 342,388 are Christians; Latakia contains 286,920; Jebel Druze contains 51,780. The principal cities are Damascus, Aleppo, Beirut, Hama, Tripolis, Antioch, Latakia, Alexandretta, and Zahlah in Lebanon. At Damascus there is a Syrian University with a faculty of medicine and a faculty of law; there are also two universities in Beirut, one French and one American. Syria is an agricultural country in general and its principal occupations are agri-

culture and cattle breeding. The chief products are wheat, barley, maize, olives, silk cocoons, and cotton. Among other important products are chickpeas, hemp and sugar-cane. Olives, apricots and grapes constitute important products of the fruit-growing industry. Sheep raising is also an important occupation. Imports in 1929 were valued approximately at 52 million dollars and exports were over 22 million dollars. The Republic of Syria was constituted under the French mandate May 22, 1930 and provided for the election every four years of a Syrian Parliament and a Moslem President. There has been considerable political unrest in the country at large and Jebel Druze was in almost continuous revolt from 1925 to 1927. Arab agitation for political independence from French domination and for a firmer economic union among the Syrian provinces is widespread. Economically Syria is still undeveloped even from an agricultural angle. Although it is estimated that over twelve and a half million acres of land have the factors necessary for cultivation, only about one-fifth of this acreage is actually under cultivation. Syria's commerce however is growing and over 4,000 sailing vessels and steam vessels annually with a total tonnage of over 2,000,000 tons now visit Syrian ports annually. In 1929 the Syrian budget balanced at about 20 million Syrian pounds, equal to approximately 15 million dollars. In this connection it is interesting to note that although the Syrian pound which is the unit of currency in Syria, is worth \$3.86 in gold, the paper Syrian pound has stabilized itself at about \$0.785. Although Syria has temporarily lost the importance it possessed in the Middle Ages as the intermediary between the trade of Europe and the East, mainly due to the diversion of trade by the Suez Canal, the country still possesses strategic importance as a link in the great trading routes of the East.

SYRIAC LANGUAGE, a SEMITIC language of the East ARAMAIC group.

The Syriac alphabet consists of 22 letters, and the consonants *b*, *g*, *d*, *k*, *p* and *t* have both an unaspirated and an aspirated pronunciation. Syriac, like MANDAËAN, differs from the West Aramaic dialects in the use of *n* instead of *i* as a prefix for the third person imperfect singular and plural, and in the loss of the determinative force of the suffixed *ā*, which originally served as the definite article. The verb has three forms, simple, intensive (change of vowels) and causative (prefixed *a*, or, rarely, *sh* or *s*); and each of these builds a passive, originally a reflexive, by prefixing the syllable *'et*. Unlike the other Semitic languages except ARABIC, the Syriac verb expresses a more definite tense with the help of the auxiliary (*h*)*wa* and the personal pronoun. The noun distinguishes two genders—masculine and feminine—and three states, absolute, emphatic and construct. In the 5th century Syriac was divided into an eastern and western dialect; but except for a slight difference in the script and, in the pronunciation of the vowels, the two are alike. The eastern group still survives in the Tur Abdin Mountains in Mesopotamia, north

and east of Mosul, and in the neighboring Kurdistan Mountains, and on the western shore of Lake Urmia.

I. M.

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SYRIAC or SYRIAN LITERATURE. The SYRIAC language, a member of the Aramaic group of Semitic languages, was spoken in Mesopotamia and Syria until the Arabian conquest of Syria in the 7th century, after which it was superseded by Arabic as a spoken language. Syriac literature is made up chiefly of theological works and translations from the Greek and Hebrew. Of pre-Christian writings in the language only fragments remain. Several versions of the Bible were made, most likely from the 2nd to the 5th centuries, and these are extremely useful to biblical scholars. The first original Syriac writer of note was Bardesanes (c. 154-222); poet, historian and philosopher, he wrote a notable *Dialogue on Destiny*. The next important author was Ephraem in the 4th century who composed hymns and wrote many commentaries and discourses. In the 5th century the principal writer was Isaac of Antioch, the poet and composer of metrical homilies. Between 400 and the Arabian conquest of Syria in 636-37 theological disputes between the Nestorians and the Jacobites dominated Syriac literature; several important histories were also written during this period, including *The Chronicle of Edessa*, the *Chronicles of Dionysius of Tell Mahre*, and a History of the Church by John of Ephesus. After the conquest, Syriac declined in general use, but was retained as a scholarly language, which gave rise to numerous grammatical works. The last great Syriac writer was Gregory bar Hebraeus (d. 1286), the author of many scientific works and a historical chronicle.

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SYRIAN ARCHITECTURE, generally the architecture of Syria, but used especially for the architecture of that portion of Syria east of the Mediterranean coast and Palestine from the beginning of the Christian era up to the time of the Mohammedan conquest. Its earlier manifestations were basically Roman, but from the 2nd century on it showed a growing independence of Roman and Byzantine precedent. The ruins of the great buildings of Hadrian at Baalbek (Heliopolis) and Palmyra are characteristic of the first phase. Roman in scale, plan and general decorative treatment, they show nevertheless marked individual traits in both construction and decoration that result from the qualities of the hard stone that was the common and almost the only monumental building material. Thus stones of enormous size were used in the basement of the Temple of Jupiter at Baalbek, reaching 60 feet long and 12 feet high. And in decoration there was a tendency towards flat, intricate, lace-like treatments quite different from the full and changing relief of Roman work elsewhere.

The rareness of wood led in the 3rd and later centuries to a continually increasing structural use of stone, which, in the Hauran, took the form not of vaults, but of slabs, for floors and roofs. Thus in the "Pretorium" of Mousmieh, great widely separated stone arches were used to support a covering of stone slabs laid horizontally. As heights in these buildings were low, the wide span of the arches forced a very low spring line; and these low, squat arches, later common in the Romanesque, became in Syria controlling forms. Another characteristic developed during the 4th, 5th and 6th centuries was the common use of false arches in which the arch shape was cut on the lower side of a single block lintel.

Meanwhile decorative detail was becoming more varied. While in the larger buildings, such as the group of Kelat Simaan (St. Simeon Stylites), there are many reminiscences of Roman Corinthian form, even these are flatter, with spikier leaves, and successions of flat decorated bands and slightly projecting moldings replace the full Roman contours. In domestic work, of which the remains are extensive, Roman precedent is almost forgotten. There are short, stumpy columns, flat incised moldings surrounding openings, and ended off with queer scrolls and drops something like those used a thousand years later in Perpendicular work in England. Houses, inns, baths, public buildings, churches, all rapidly developed characteristic Syrian types. Secular buildings of several stories were common. Houses were usually on one or two sides of a walled court, with colonnades on each floor. Inns were successions of chambers with a walled court, perhaps the parent form of the later Asiatic Khan. Baths were successions of rectangular rooms, with many evidences of refinement and luxury in arrangements and fittings. Churches were of both the centrally-planned, polygonal or circular (Ezra), and the basilican (St. Simeon Stylites at Kelat Simaan and the church at Kalb Louzeh) types.

Syrian architecture is important because of its effect upon Byzantine ornament, and also the development of many church types. For bibliography see **BYZANTINE ARCHITECTURE**.

T. F. H.

SYRINGA, a name widely given to a large genus (*Philadelphus*) of shrubs of the saxifrage family, often called **MOCK-ORANGE**, many of which, in numerous varieties and cultigens, are cultivated for ornament. There are about 40 species found in north temperate regions, chiefly in the United States and Mexico. They are erect shrubs with opposite simple leaves and usually white, orange-like, often very fragrant flowers. The Lewis syringa or mock-orange (*P. Lewisii*), a handsome species found from Montana and Wyoming to Washington and California, is the state flower of Idaho. The garden syringa (*P. coronarius*), called also orange-flower tree, native to Europe, with creamy-white highly fragrant flowers, is sparingly naturalized in the eastern states. The similar scentless syringa (*P. inodorus*), native to the southeastern states, is likewise widely cultivated. *Syringa* is also the generic name of the **LILAC**.

SYRUPS, sweet, sirupy liquids from various sugar containing materials. Beet syrup is the juice of sugar beets clarified and evaporated. Corn syrup (commercial glucose) is made from corn starch by partially converting the starch to the sugars dextrose and maltose, clarifying, refining, and evaporating. It is not made from corn stalks. Natural flavored fruit syrups are produced by adding the fruit juice, concentrated by special processes, to neutral sugar syrup. **HONEY**, see article on **HONEY**.

Malt syrup and maltose syrup are made from a starchy source, usually corn, and contain more or less barley malt extract. The enzyme diastase supplied by the malt partially converts the starch into the sugar maltose. Malt syrups are usually less highly refined than maltose syrups; maltose syrup is more suitable for table purposes and confectionery manufacture.

Maple syrups are made from the sap of the sugar **MAPLE**; skimming, evaporating, settling and straining are required in reducing the sap to maple-sap syrup. No sugar is removed. Pure maple syrup is also prepared by dissolving pure maple sugar (maple concrete) in water, but this product is not maple-sap syrup.

Sugar syrups are obtained by dissolving any sugar (see **SUGAR AND ITS MANUFACTURE**) in water, principally cane, beet or invert sugar. Refined, brown, raw and other grades of sugar give syrups of varying color and flavor.

Sugar-cane syrup is made by grinding sugar-cane stalks, clarifying and evaporating the juice, without removing any sugar. Also by dissolving true sugar-cane concrete in water, but not by dissolving any of the common grades of commercial sugar.

Sorghum syrup recently known as sorgo syrup, is obtained by evaporating the clarified plant juice from the sorgo stalks without removing any sugar. Granulated sugar is not manufactured commercially from sorgo cane.

Refiner's syrup is syrup separated from crystallized sugar in a raw sugar refinery. Better grades are sometimes called "Golden Syrup." In the manufacture of sugar directly from sugar-cane juice, the corresponding

product is called **MOLASSES**. Treacle is the name given to refiner's syrups and to molasses in general in Great Britain.

Mixed or blended syrups are made by mixing two or more syrups to secure any desired color and flavor: pure maple syrup with cane sugar syrup; pure sugar-cane syrup with corn syrup, or with cane sugar syrup; cane molasses and sorgo syrup with corn syrup.

Artificially flavored syrups are manufactured by adding artificial flavor to a bland, neutral flavored sugar syrup or corn syrup. C. F. W.

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SYZYGY, the name given to the occasion when the moon is in conjunction or in opposition with the sun, that is, at new moon or at full moon.

SZATMAR. See **SATU MARE**.

SZEGED or **SZEGEDIN**, a city of Hungary situated near the Rumanian and Yugoslav frontiers at the confluence of the Maros and Tisza rivers, a railroad center and steamship station. In Mar. 1879 a devastating flood swept away practically the entire city and about 2,000 people were drowned. The city was rebuilt and surrounded by dikes. A modern city with ring boulevards and radial streets, well-paved and planted with trees, having monumental buildings and seven fine squares, resulted. There are several churches, a city hall, governmental buildings, and the handsome "Cultural Palace" with a large library. The former university, founded in Kolozsvár, now Rumanian Cluj, in 1871, was transferred to Szeged in 1921. There are also many advanced and elementary schools and 4 religious houses. The city engages in shipbuilding, milling and flax weaving, and manufactures furniture and silk goods as well as agricultural products. Its size was increased by incorporating neighboring villages. In 1918 Szeged was headquarters of the French, under whose protection from May, 1919, to August, 1919, the anti-Bolshevik Hungarian government sojourned in the city. Pop. 1930, 135,131.

T

TABARD, THE, an old London inn on High Road, Southwark, near Kent Road, immortalized in Chaucer's *CANTERBURY TALES* as the meeting-place of the pilgrims who were going to Canterbury. It was so called because its sign was a tabard, or sleeveless jacket. After the Great Fire of 1666, the inn was known as the Talbot, surviving under that name until late in the 19th century, when it was demolished.

TABASCO, a state of Mexico, occupying a part of the peninsula of Yucatán, with an area of 10,374 sq. mi. The surface is low and flat, sloping somewhat to hills in the north. These are covered with dense, unexplored forests of tropical trees, and the lowlands are dotted with swamps and lakes. The state is noted for its many important rivers, which serve as almost the only means of transportation in the interior, and as harbors at their estuaries. The most noted of these rivers are the Usumacinta and Grijalva, both navigable for many miles. Principal products are fruits, logwood and chicle gum. The capital is Villa Hermosa, and other towns are Frontera and Chilapa. Pop. 1921, 210,437; 1930, 223,838.

TABERNACLE, a portable *SANCTUARY*, or tent of meeting, a tent-like structure which the ancient Hebrews carried with them on their wilderness wanderings and which they brought with them into the land of Canaan. During the entire wilderness period the Tabernacle was the place of the worship of God. After the Hebrews' entrance into Canaan it was set up at Shiloh, in the tribe of Ephraim, where it existed for some time. The Tabernacle, like the later *TEMPLE*, was called the sanctuary because the holy ark containing the tables of the covenant were deposited in it, and because only consecrated priests were allowed to enter its inner chambers. The Tabernacle was later replaced, about 970 B.C., by the Temple of Solomon at Jerusalem, with its permanent sanctuary. In Hebrew the Tabernacle was usually called *mishkan* or *ohel moed*.

According to the description in Exodus 26-27 and 35-38, the Tabernacle and its vessels were made by Bezalel and his associates. It was built of acacia-wood and had a veil, a curtain, a forecourt, and an altar, all portable, and easily taken apart and set up again. Moses himself consecrated the Tabernacle to the service of God, and it was conceived of as the sign of God's presence in the sanctuary. Its significance as the tent of meeting may be due either to the fact that it was the people who gathered there for worship or for important assemblies, or to the fact that it was here that the Deity was conceived of as meeting with the leaders of the people, according to a very old conception, of which certain traces are found in the Bible. The Tabernacle is mentioned only at rare intervals in the period after the wilder-

ness wanderings when it had been set up at Shiloh. Originally, however, according to older Biblical sources, the Tabernacle appears to have been merely a simple tent outside of the camp where those who wished could consult Yahweh. (cf. Exodus 33:7-11.)

After the destruction of the sanctuary at Shiloh the Tabernacle was no longer mentioned. Even in the description of the dedication of the Temple of Solomon (I Kings 8), which was expressly built for the purpose of replacing the Tabernacle, no mention of the Tabernacle is made. It appears to have disappeared utterly, a fact which, together with the evident impossibility of constructing such a lavish, massive and sumptuous Tabernacle in the wilderness, casts serious doubts on the historicity of the Tabernacle and it is not unlikely that it never existed in actuality, but represented merely a projection into the past of conditions prevailing at the time of the First Temple, indeed, as a projection of the Temple of Solomon itself into the pre-Canaanite and pre-Solomonic periods, or possibly as a projection into the wilderness period of a great tabernacle conceived during the Babylonian Exile or after the return from the Babylonian Exile, after the centralization of the worship of God had become a permanent and distinctive feature of the Jewish religion. Then the original Tabernacle as the tent which Moses used to pitch outside the camp was artificially and unhistorically glorified and magnified into the great, elaborate and sumptuous Tabernacle of later times, as portrayed in Exodus 26-27 and 35-38. A. SH.

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TABLE, an article of furniture on which things can be conveniently set, consisting of a flat top raised horizontally off the floor by legs or other support. Until about 1500 few real tables were made except for the wealthy, and these were often works of art. From very early times, however, loose boards on trestles were used as dining tables. Sometimes the trestles

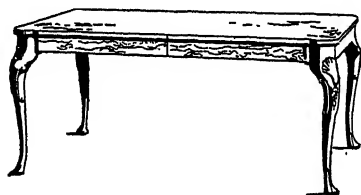


COURTESY M. M. OF ART

AMERICAN TRESTLE TABLE WITH PINE
TOP AND OAK FRAME (ABOUT 1650)

were handsomely carved. The side table, with its drawer or cupboard below, was evolved from the *CHEST*, and that the chest itself was often used as a table is evidenced by some 16th century oak chests whose tops are marked off for chess.

The Romans made a variety of tables, having all shapes of tops, with one, three or four legs, and using wood, marble, gold, silver and bronze, ornamented with carving, inlaying, engraving, damascening or veneering. Animal designs, especially lions and sphinxes, were especially favored. In the later Middle Ages movable trestles were replaced by fixed tables; drawing tables, containing extension leaves, also became popular. Flap tables of the gate-leg variety were known by the 17th century. Gothic patterns still lingered in Elizabethan England and blended with the classical designs of the Renaissance. Table-legs veered in style from the straight, rectangular Gothic to bulbous, turned and carved monstrosities, subsiding again into slender simplicity, until the style of Louis XIV overloaded them with gilded ornament



COURTESY JOHN WIDDICOMB CO.
WALNUT DINING TABLE OF THE QUEEN
ANNE PERIOD

in high relief, after which they twisted themselves into the endless scrolls and undulations of the Louis XV period, but finally settled down to the restful, classic lines of Louis XVI. In the 19th century most tables were machine-made and of mixed styles. The most original tables of the 20th century have been in the modernistic style. *See also* TEA TABLE.

TABLEAU, a picture formed by people posing and remaining still in fixed positions. The tableau is used in theatrical productions, sometimes to represent historic events and sequences; but usually it serves merely to illustrate a beautifully designed grouping of figures. Various effects are obtained by changing the lighting. For amateur theatricals, tableaus are sometimes given in conjunction with the reading of a poem or story, to bring out striking points. When used as a parlor amusement, those taking part in the tableau require the audience to guess what they represent.

TABLES, MATHEMATICAL. Tables to reduce the tedious work of computers in mathematics, astronomy, engineering and other sciences, were first introduced to the scientific world in the 17th century. With the invention of logarithms in 1614 came the discovery that the work of the computer could be greatly reduced by the construction of logarithmic tables, the use of which replaced the process of multiplication and division by addition and subtraction respectively. Other tables designed to facilitate computing of various kinds immediately found their way into the hands of scientists. Among these were to be found tables of trigonometric functions, squares, cubes, and higher powers, square and cube roots, reciprocals, products, and even of the more complex functions met with in

different branches of science. In many cases not only were the results tabulated but also the logarithms of the results.

Since the purpose of a table is to lessen labor it is essential that great care be exercised in its construction. It is usually arranged so that the printed page does not present a solid mass of figures, the size of the figures and their spacing being other factors which have to be considered as well as the accuracy of the result.

The numerical value of the result is tabulated for certain values of the argument; in a table of logarithms, a number whose logarithm is desired is the argument, the logarithm itself being the result. Most tables now in use also supply the logarithm of the result.

In the following description of the most commonly used tables may be found a discussion of their essential features. Textbooks in elementary mathematics are usually equipped with tables peculiar to their subject.

I. Common Logarithms of Numbers. The argument is generally found in the first column; the interval between any two values of the argument is divided into tenths and placed at the top of the page. The logarithm is made up of two parts: the mantissa, which is the tabulated result, and the characteristic, which must be supplied by the computer. The tabulated result is found in the remaining 10 columns of the page.

II. Trigonometric Functions. In a table of sines, cosines, tangents and cotangents of the angles from 0° to 90° the argument is usually given to degrees and minutes. Tables of the trigonometric functions are used extensively in engineering.

III. Squares and Cubes. A table, still current, although its necessity has been somewhat obviated by the adoption of the calculating machine in computing work.

IV. Interest and Investment Tables. Tables of compound interest, present and accumulated values of annuities, with their logarithms. The compound interest table lists the amount of \$1.00 at the more common interest rates for a varying number of years. Tables of the amount which will accumulate to \$1.00 in so many years at varying interest rates are also current.

Tables of the present and accumulated values of an annuity of \$1.00 per annum at the more common interest rates are to be found, together with tables of compound interest, in most textbooks on the mathematical theory of investment.

J. H. B.

TABLE TALK, collections of the opinions and conversations of noted men, uttered in informal discussions. In the 19th century it was a favorite method of publishing intimate knowledge concerning great men, examples being *Table Talk and Opinions of Napoleon Buonaparte*, 1868; *Table Talk and Imaginary Conversations of Pope and Swift*, by LEIGH HUNT, 1851; and *Specimens of the Table Talk of S. T. Coleridge*, by Henry N. Coleridge, 1835. The

American author, OLIVER WENDELL HOLMES, published his own table talk in the popular *Breakfast Table* series. *Table Talk of G. B. S.*, 1925, is a record of conversations between George Bernard Shaw and Archibald Henderson.

TABLE TURNING, the movement of a table, on which the sitters' hands are placed, regarded as the work of spirits acting through a medium. It formed the chief feature of the manifestations of Eusapia Paladino, who excited great attention as late as 1910, but was detected in raising the table by her foot. It figures also in the performances of Katherine Goligher (see *ECTOPLASM*).

In the cruder phenomena the table simply turned, moved rapidly, gyrated and raised itself by the involuntary movements of the sitters. The use of the table legs to rap out messages provided a form of communication (see *PLANCHETTE*). J. J.

TABOO, a Polynesian word conveying the idea that certain things or certain persons are charged with a supernatural force. They radiate power, which is beneficent if properly handled but which can kill if ignorantly approached, much as a charged electric wire could kill. Many primitive societies both in Polynesia and other parts of the world have taboo rules against touching people or things which they consider magically dangerous, such as chiefs, women in childbirth, murderers, hunters, iron, weapons, blood, the head, the hair and innumerable kinds of food. Some rules are practised only at specified seasons or by specified peoples; others are in continual operation. In some instances certain names are taboo.

TABRIZ, also known as Tavis and Tebris, capital of the Arzerfaijan province in Persia. It is next to Tehran in size. It is situated on the Aji River, about 320 mi. southwest of Tehran. The city is a veritable pile of mosques, of which there are over 300. In the 3rd century Tabriz, then called Tauris, was the capital of an Armenian king. Timur the Tatar captured the city in 1392. Arabs, Seljuks, Turkomans and Mongols held it afterwards. In the year 1500 it fell into Persian hands. Here also are numerous shops, baths, warehouses and the ruins of a large medieval castle. A maze of narrow, tortuous streets wind amid endless rows of poorly built houses. Tabriz, noted for its rug making, is the distributing point of the dried fruit for which the Arzerfaijan province is particularly famous. Carpets, hides and live animals are exported, and tea, sugar and woolen stuffs are the chief articles of import. Occupying a commanding position on the route between Trabzon and Erzurum, for many decades Tabriz was the chief commercial city of Persia, but the opening of the Suez Canal and the construction of the trans-Caucasian railway transferred a great part of the commercial traffic. Est. pop. 1930, 200,000.

TABULATING MACHINES, combinations of sorting devices and adding machines used in compiling statistical information. The cards containing the information are punched with holes corresponding to the class in which they belong and to the statistical

information which they contain. On passing through one machine these cards are sorted by a mechanism actuated by pins passing through the holes and on passing through a second machine by groups the statistics are added by a similar mechanical action.

TACAMAHAC, the Indian name for the balsam POPLAR (*Populus Tacamahacca*), native to northern North America from New England to South Dakota and Alaska and much planted within its range for wind-protection and ornament.

TACHEOMETRY, also known as the Stadia Method, a system of measuring distances by sighting a TRANSIT at a graduated rod and noting the number of graduations that is intercepted between two lines placed in the focal plane of the eyepiece of the transit. The space between the lines is such that the distance equals 100 times the space intercepted on the rod. This same end may be attained by placing in front of the object-glass of the transit a prism having a throw of 1 in 100, which produces a double image of the rod, one image being displaced with reference to the other by an amount equal to one per cent of the distance. In order to obtain the total distance from the rod to the center of the instrument, a small quantity must be added, the calculation for which can be found in any book dealing with Surveying. The equation is rather complicated, and for approximate measurements, distance equals $100 \times$ intercepted rod space is usually sufficient. For a closer approximation, a small constant found by computation or by trial, should be added. This system of measuring distances is used extensively in topographical SURVEYING, and is ordinarily much more rapid than taping. It is applied both with the transit and with the ALIDADE of the plane table. See MAPS AND MAPPING; also TOPOGRAPHY. G. L. H.

BIBLIOGRAPHY.—Bulletin 788, *Topographic Instructions*, U.S. Geological Survey, 1928.

TACHOMETER, an instrument for indicating the speed of any rotating shaft to which it may be connected. There are two principal types, centrifugal and chronometric. A centrifugal tachometer utilizes a system of restrained fly-weights whose position is continuously indicated by a hand to which their motion is transmitted. Chronometric tachometers contain counting and timing mechanisms which give an approximately continuous indication of the number of turns in each counting period.

Among the tachometers frequently used in practice are the vibrating reed and the electrical types. The vibrating reed tachometer is made up of several reeds each of which vibrates in tune with a certain frequency. The machine vibration communicated to the tachometer sets into sympathetic vibration the reed corresponding to the particular frequency or speed. Electrical tachometers consist of a magneto generator which generates an electromotive force which varies with the speed. This generated voltage is measured on a special voltmeter calibrated in revolutions per unit of time rather than in volts. See also SPEEDOMETERS. C. H. C.

TACITUS, CORNELIUS (c. 55-c. 117 A.D.), Roman historian. A member of the aristocracy, he married, in 78, the daughter of Agricola, who a few years later gained distinction by his victories in Britain. Moreover in 97 Tacitus was honored with the consulship by the emperor Nerva. His life was largely devoted to writing. His first work the *Dialogus de Oratoribus* discusses the orators of his own day and compares them with those of republican times. Next Tacitus wrote the *Agricola*, an artistic and moving biography of his father-in-law, and the *Germania*, a descriptive sketch of Germany and the Germans. But Tacitus' most important writings are his *Historiae* and *Annales*. The *Historiae*, containing in all 14 books, covered the period between 69 and 97 A.D. and the *Annales* treated Roman history from 14 to 68 A.D. Unfortunately, only the first four books and part of the fifth book of the *Historiae* survive, containing a detailed account of the confused events of the year 69, and of the *Annales* nine books have survived entire and three more in part. The reign of Tiberius is almost entirely included in the extant portion as is the latter part of Claudius' reign and nearly all of Nero's. The account of Caligula's reign is entirely lost. Tacitus has a remarkable gift for short, epigrammatic statements, and writes with much variety and poetic coloring. He is to be trusted in his statements of facts, but when he describes the motives underlying outward actions his anti-imperial bias is often revealed. Tacitus died about 117.

TACKLES, combinations of Blocks and Rope, for handling heavy weights. They are extensively used on board ship, either in connection with the masts and cargo booms, or on small portable derricks. Tackles commonly used are the following: single whip, consisting of a single fixed block; double whip, two single blocks; Spanish burton, two single blocks, one fixed and the other movable; runner, a single movable block.

TACNA, a town of southern Peru, and capital of the province of the same name, situated about 38 mi. north of Arica, Chile. It is enclosed by the Andes on the east and by the Coast Range on the west; it has an arid climate. Tacna was administered by Chile until a treaty was signed in 1929 between Peru and Chile; this treaty disposed of the long-disputed Tacna-Arica question by awarding Tacna to Peru, Arica to Chile. Tacna is in an agricultural and mining district. Est. pop. 1927, 18,000. See LATIN AMERICA.

TACOMA, a city and county seat of Pierce Co., in the western part of the state of Washington. It is situated on Commencement Bay, at the head of navigation of Puget Sound and at the mouth of the Puyallup River, about 114 mi. from the Pacific Coast and 32 mi. southwest of Seattle. The city is served by the Great Northern, Northern Pacific, the Chicago, Milwaukee, St. Paul and Pacific, and Union Pacific railroads. It is the terminus of a Japanese transpacific steamship line and 68 other local and foreign lines. Tacoma has a large wholesale and jobbing trade, deals

in lumber and lumber products and has flour-milling, fishing and ore smelting industries. In 1929 the value of the manufactures was about \$140,000,000; the wholesale trade proper amounted to \$28,224,301, and the retail trade, to \$61,938,063. In 1930 the vessel traffic tonnage was 2,817,684, valued at \$136,675,921; the floated timber tonnage was 2,141,679, valued at \$8,816,097. The city has several denominational colleges.

Because Mt. Rainier, known locally as Mt. Tacoma, 14,520 ft. high and capped with snow is only 50 mi. southeast, Tacoma is sometimes called "the city with a mountain in its door-yard." The original name of the settlement was Commencement City, but the present name, said to be a corruption of an Indian term meaning "greatest white peak," was soon adopted. Tacoma was founded in 1868 by Gen. Morton Matthew McCarver and in 1875 became incorporated as a city. Pop. 1920, 96,965; 1930, 106,817.

TACONIC STATE PARK, a tri-state park which is planned to comprise 9,000 acres in New York, 11,000 acres in Connecticut and 20,000 acres in Massachusetts. The idea of establishing a park on the high plateau of the Taconic Mountain region was first conceived in 1923. New York has acquired 4,000 acres for the park in Dutchess and Columbia counties and Massachusetts 390 acres at Bish Bash Falls.

TACTICS, the art of leading troops in battle. The principles of war or strategy (see STRATEGY) are also the principles of tactics. Certain additional principles are considered to apply more specifically to tactics. The principle of reserve requires holding out a portion of any force at the outset of a tactical enterprise to meet unforeseen developments. Tactical success depends on maneuver. Maneuver is made possible through fire superiority and proper use of the terrain. These are respectively the principles of fire and movement, fire superiority and ground and cover.

Infantry. Infantry tactics is the basis of combined tactics. In the offensive, infantry passes through certain successive stages. The advance to find the enemy is in route column, usually a column of squads or fours for economy of road space and control. The column is preceded by a security detachment called an advance guard. It has such flank protection, flank guards, as is necessary. As the column nears the enemy it breaks into smaller columns which march toward points convenient to the areas from which each will launch its attack. This is known as development. Approach march begins when units enter the zone of hostile artillery fire. Formations permitting advance under shell fire are assumed. In the next stage, deployment, units form for attack on or near a line designated in orders. Infantry deploys for attack by arranging the elements of its assault (front-line) units, usually rifle companies, in successive waves. Reserves of battalions, regiments and brigades follow at varying distances in rear. Leading elements are closely supported by machine guns and other weapons, and may be preceded by tanks. Each as-

sault unit is assigned a direction and zone of attack. In the attack the infantry endeavors to advance close to the enemy defenses. Advance of leading elements is by infiltration, a process in which individuals or small groups move from cover to cover. In the assault, the culminating stage of the attack, infantry elements close with the enemy. If the assault is successful troops are speedily reorganized for continuing the attack against the next hostile position or following in pursuit. Pursuit, if not within range of hostile artillery, is in route column.

Attacks are classified as frontal attacks, penetrations, envelopments and turning movements. A frontal attack, launched uniformly against the enemy's entire front is least desirable since it encounters the opponent's full strength. A penetration endeavors to break through the enemy front at a particular point and is desirable when his front is overextended. In an envelopment, part of the force holds the enemy in front while the balance attacks his flank, overlapping it. In a turning movement part of the force holds as in the envelopment, while the balance of the force makes a wide detour and attacks the hostile rear.

When, for any reason an attack is definitely stopped, infantry organizes for defense. A defensive position should afford observation and field of fire to the front and flanks. The ground on which it is planned to offer the main resistance is the battle position. To the front and flanks are posted security detachments (*see OUTPOSTS*). The forward element of the battle position is the firing line and consists of small rifle groups located at intervals on commanding points of the terrain. Firing line groups are supported by other groups similarly disposed on the support line a short distance in rear of the firing line. Further to the rear are located successively battalion and regimental reserves. In rear of the battle position are located the reserves of higher units. A defensive system may consist of a series of battle positions. The attacking enemy is first met by the outpost which delays him and seeks to deceive him into premature deployment or deployment along incorrect lines. As the attack approaches closer all the available fire power of the infantry is coupled with that of the artillery in the endeavor to gain fire superiority and halt the advance. During the assault stage firing line groups are assisted by the flanking fire of adjacent groups and machine guns. Support groups by local counter attack seek to restore firing line positions lost. Larger enemy successes are met first by battalion and regimental reserves and finally by the reserves of large units. Infantry withdraws from action by alternately disengaging units. Those in contact with the enemy withdraw under cover of the fire of supports and reserves. Units withdrawn assist the withdrawal of the initial covering forces. When the withdrawal assumes the form of a retreat the march to the rear is in route column followed by a security detachment called a rear guard.

Cavalry. Cavalry is the basic arm for reconnaissance. During the infantry route march it screens

the front and flanks of the column against surprise and seeks enemy information. Cavalry continues its operations to the front until the infantry gains contact, when it withdraws to positions on the flanks from which it can harass the enemy flanks and rear, carry out its reconnaissance and security missions and prepare to assist in pursuit or withdrawal. In the pursuit the mobility of cavalry permits it to overtake the hostile infantry and attack its flanks. In the withdrawal or retreat it delays the enemy by attacks against his flanks and forms a screen in rear of the retreating march column. Cavalry may fight mounted or on foot. Due to the efficacy of modern automatic weapons a mounted attack by large units is considered impracticable unless fire superiority and the surprise element are both present to a very high degree. Dismounted, cavalry fights as infantry and employs similar tactics.

Artillery. The rôle of artillery is fire support of the infantry. Light artillery, 75 mm., is employed for direct support, normally a battery to each infantry battalion. Heavier artillery is employed for more general support and for counter-artillery fire. During the march artillery is distributed in the column so as to give immediate support when contact is gained by infantry. It covers the development, approach march and deployment. Before the attack it may deliver an artillery preparation in the form of an intense bombardment of the enemy front lines. As the infantry advances the preparation passes to successive concentrations or rolling BARRAGES, interdiction of roads or areas and counter-battery fire. In the pursuit, artillery assists in the demoralization of the enemy by neutralizing covering forces and firing on retreating columns. In the defense, artillery fire is as carefully coordinated as time will permit to cover with the greatest density all ground over which the enemy will probably advance. As the enemy attacks fire is concentrated on his infantry and protective barrages are placed in front of the defensive position. In case of withdrawal artillery covers retirement by concentrations placed on the most threatening hostile troops.

Air Service. During the route march its principal function is to obtain enemy information through visual reconnaissance and aerial photography. In the successive stages of the offensive, in the defense, and in withdrawal the air service (*see MILITARY AVIATION*) continues reconnaissance and carries out the following additional tactical missions: maintains contact between ground units, reporting their progress to higher unit headquarters; observes and adjusts artillery fire; protects ground troops from enemy air service; harasses the opponent by attacking his troops and sensitive points with machine guns and bombs.

Engineers. The principal functions of engineers with respect to combined tactics are to facilitate movement of troops and supplies by road and bridge repair and construction, to supply fortification materials to combatant troops and to construct defensive field fortifications. In emergencies engineers are as-

signed combat missions. In such case they employ the tactics of infantry rifle units. E. D. P.

TADZHIKISTAN, or Tadjhik S.S.R., one of the seven constituent republics forming the U.S.S.R., in Soviet Central Asia. It was organized in 1929 from parts of Bokhara and Turkestan. To the west and north lie Uzbekistan and the Kirghiz autonomous republic; to the east is Chinese Turkestan, and to the south, Afghanistan. Its area of about 55,000 sq. mi. is composed largely of plains and mountains. The principal river, upon which steamships ply, is the Oxus. The highest peak, Mt. Kaufmann, rises to an altitude of 23,386 ft. The inhabitants are 75% Tadjhiks, central Asian aborigines of Aryan origin; the principal minority group are semi-nomadic Uzbeks composing 21% of the population. In the plains they engage in trade, cattle raising and agriculture, and with the advancement of irrigation projects increasing quantities of cotton are being grown. The most fertile valleys, where farming is extensive, are called *pamirs*. The mountain Tadjhiks live in independent groups; their language varies greatly and their customs are partly feudal and partly patriarchal. An Aryan dialect, with a strong admixture of Turkish, is principally employed throughout the country. Primitive methods prevail in tapping the abundant gold, oil and coal resources. There has been little education, and poor means of communication, but recently a modern railroad 140 mi. long has been constructed connecting Termez and STALINGRAD, Tadjhikistan's capital and only important city. Pop. 1931, 1,174,100.

TAEL, a Chinese unit of weight, equal to $1\frac{1}{3}$ oz., and a monetary unit representing this weight of standard silver. The value varies in different parts of China, but is about 34 cents at Peiping and Shanghai.

TAENSA, a sub-group of the Natchez, a North American Indian tribe speaking a dialect of the Muskogean linguistic stock. They are now extinct as a tribe, although some Chitimacha are descended from them. From their initial encounter with white explorers and missionaries they moved from place to place along the lower Mississippi River in Louisiana, going finally, about the time of the Louisiana Purchase, to Grand Lake, La.

TAFT, LORADO (1860-), American sculptor, was born at Elmwood, Ill., Apr. 29, 1860. He graduated from the University of Illinois in 1879, and studied sculpture at the Ecole des Beaux Arts, Paris, 1880-83. On his return to America, he located in Chicago, and from 1886-1901 he was an instructor at the Art Institute. His lectures there and elsewhere in the United States have exercised a marked influence on the development of sculpture in the Middle West. In 1911 he became a member of the National Academy, and from 1925-28 of the National Committee of Fine Arts. Besides extensive portraiture, his principal works include: *Solitude of the Soul*, at the Art Institute, Chicago; *Blackhawk*, Oregon, Ill.; *Columbus Memorial Fountain*, Washington, D.C.; *Ferguson Fountain of the Great Lakes*, Chicago; *Thatcher Me-*

morial Fountain, Denver; *The Fountain of Time*, Chicago; *Lincoln*, Urbana, Ill.; *The Pioneers*, Elmwood, Ill.; *Alma Mater*, University of Illinois. He is author of *The History of American Sculpture*, first issued in 1903, and republished in revised form in 1924; and of *Modern Tendencies in Sculpture*, 1921.

TAFT, WILLIAM HOWARD (1857-1930), 26th President of the United States, was born at Cincinnati, O., Sept. 15, 1857. He was the son of Judge Alphonso Taft, Attorney General under Grant in 1876-77, and Louisa M. (Torrey) Taft, both of English descent. Educated at Yale, he graduated in the class of 1878. He graduated from the Cincinnati Law School in 1880, and the same year was admitted to the Ohio bar.

Taft's academic record at law school obtained for him the appointment in 1881 of Assistant Prosecuting Attorney of Hamilton Co., including Cincinnati. He remained in this office for one year, resigning to accept a federal appointment as Collector of Internal Revenue in the 1st Ohio district. This office Taft resigned in 1883, for private practice, but in 1885 he accepted an appointment as Assistant Solicitor of Hamilton Co. In this post he remained until 1887, when Gov. Foraker noted his outstanding qualifications, appointed the 30-year-old attorney to finish an unexpired term as judge in the Ohio Superior Court.

The following year Taft proved himself capable of winning elective office by campaigning successfully for the judgeship on the Republican ticket. In 1886 he married Helen Herron of Cincinnati. He was appointed Solicitor General of the United States under Harrison in 1890. Taft soon proved his qualifications for the federal post by his arguments in the Bering Sea arbitration. In 1892 he was appointed judge of the sixth circuit in the United States Circuit Court of Appeals. Taft's opinion, handed down in this office, that labor has the right to organize but not the right of industrial reprisals harmful to society, established an important precedent in the judicial history of American industry. Cognizance of his authority in the law was taken by the University of Cincinnati which appointed him dean of the Law School for 1896-1900. In the latter year President McKinley selected Taft as chief of the commission organized to establish civil government in the Philippines. In this post he displayed unusual administrative skill and tact, and in 1901 he was appointed the first civil governor. He remained in this arduous office four years, twice refusing President Roosevelt's proffered appointment to the United States Supreme Court, on the grounds that his immediate duty was at Manila. On his return in 1904, he was appointed Secretary of War. In this office he took charge of Cuban affairs after the fall of the island government in 1906, inspected the Panama Canal, opened the first Philippine legislative assembly in 1907, and visited Japan and China in the interests of good will. Roosevelt launched a movement to name him for President at the Republican Convention in 1908. Taft

was duly nominated, and defeated Bryan by 321 to 162 electoral votes. He took office in Mar., 1909.

Taft took office at a time of strident clamor for reform, and although his administration was marked by many notable changes and improvements in government, his attitude towards reform was not sufficiently ardent for the temper of the time, and he came to be regarded as a conservative, by many, as a reactionary. A brief enumeration of his achievements seemingly would deny the correctness of the judgment. In addition to a continuation of the Roosevelt anti-trust policies, railroad regulation, civil service extension, encouragement of arbitration and conservation, the demands of many years' standing were realized in the creation of the postal-savings system, the parcel post, a tariff board of experts, a new cabinet department of labor, taxation of corporation profits, and the 16th and 17th Amendments to the Constitution which respectively provided for a graduated income tax and the direct election of senators. The Republican platform of 1908 had promised to call a special meeting of Congress immediately after the presidential inauguration to revise the tariff, which was regarded as too high, and Taft, himself, during the campaign asserted that the tariff must be reduced. Taft, as promised, summoned the special session of Congress on Mar. 15, 1909, which promptly passed the Payne-Aldrich bill amidst the insistent demands of affected business interests. The new tariff was in no sense the promised downward revision of schedules, and Taft's signature of the bill infuriated many who regarded it as an act of betrayal. He further alienated liberal sympathy by the dismissal of Gifford Pinchot, chief of the Forestry Service, as a result of a controversy between Pinchot and his superior R. A. Ballinger, Secretary of the Interior, who had been openly accused by Pinchot of favoritism and friendliness to interests which wanted to exploit the public domain. Secretary Ballinger resigned after being cleared of Pinchot's charges by a joint congressional investigating committee, but the whole episode reacted against Taft, although he was largely responsible for the passage of a series of acts which were approved by the National Conservation Association.

Taft further irritated the liberals in 1910 by his appointment to the Chief Justiceship of Edward D. White whose decisions as an Associate Justice had been uniformly favorable to large corporations. Taft added to his embarrassments by summoning an extra session of Congress in Apr., 1911, for the purpose of passing a bill providing for Canadian commercial reciprocity. (See TAFT-FIELDING RECIPROCITY AGREEMENT.) After its signature by him, Canada eventually refused the plan, and Taft was confronted by a Congress in session which proceeded to pass several tariff acts which he vetoed. Although the last two years of Taft's administration was a record of progressive achievement, he could not overcome the unfavorable impression of the first two. The policies which offended the liberals endeared Taft to the conservative

faction of the Republican Party which controlled the machinery of the National Convention of 1912. This control was exercised to prevent the seating of Roosevelt delegates to the Convention, thus assuring Taft's nomination. Roosevelt bolted the party for the Progressives and in a contest between Wilson, Roosevelt and Taft, Taft obtained the electoral votes of Utah and Vermont only.

In 1913 Taft was appointed Kent professor of law at Yale, and the same year elected president of the American Bar Association. President Wilson in 1918 appointed him to the War Labor Board as arbitrator, and in 1919 he lectured in support of American membership in the League of Nations. Following the death of Chief Justice White in 1921, President Harding appointed Taft as his successor. Two years later he became Chancellor of the Smithsonian Institution. As Chief Justice, he reorganized the Supreme Court machinery, increasing its efficiency in disposing of cases. Illness forced him to resign on Feb. 3, 1930. He died at Washington, D.C., Mar. 8, 1930, of cerebro-arteriosclerosis, and was buried in the Arlington National Cemetery.

Taft had two sons, Robert Alphonso Taft (1889-), lawyer and member of the Ohio House of Representatives in 1921-26; Charles Phelps Taft II (1897-), lawyer and prosecuting attorney of Hampton Co., O., in 1927-28; and a daughter, Helen Herron Taft (Manning), (1891-), was dean of Bryn Mawr College 1917-20 and was reappointed in 1925.

Taft was the author of *Popular Government* (1913) and *The Presidency* (1916). He attended services of the Unitarian church.

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TAFT-FIELDING RECIPROCITY AGREEMENT (1911), an attempt to establish commercial reciprocity between the United States and Canada, unexpectedly rejected by the Canadian electorate. Discussion between W. S. Fielding, Canadian Minister of Finance, and President Taft, in which Taft took the initiative, led to a conference of American and Canadian commissioners at Ottawa and Washington. On Jan. 26, 1911, an agreement was reached whereby agricultural, dairy, lumbering and mining products and fish were in most cases to be admitted from one country to the other free of duty; substantial reductions were to be made in the tariffs on many essential manufactures and on meats. The agreement was to be made effective by concurrent legislation. In the United States protectionist Republicans, the New England fishing interests and Western farmers and lumbermen opposed the agreement vigorously. Regular Republicans, the Democrats, tending in principle toward free trade, and financial interests in the East, convinced that reciprocity would facilitate their endeavors to gain control of the Canadian market, supported Taft. In Canada the terms of the agreement were hailed as a triumph for the Laurier administration; Robert L. Borden, leading the Conservative Opposition, however, sponsored a movement

against the agreement which gradually gained strength. The opposition was only secondarily economic, being primarily emotional; unwise remarks of prominent Americans, including Taft, which stated or implied that reciprocity was a step toward the annexation of Canada, roused nationalistic sentiment. "Vote against National Suicide" was an effective slogan. In the United States the Reciprocity Bill was passed on July 22; Laurier, unable to surmount the Conservative filibuster in Parliament, appealed to the country. The elections of Sept. 21, manifesting the results of the organized opposition of the railroad, banking and manufacturing interests of eastern Canada and to some extent expressing anti-American sentiment, were a Conservative triumph; the reciprocity program fell with Laurier.

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TAGALOG, a Philippine language of the INDONESIAN branch of the MALAYO-POLYNESIAN linguistic family, spoken by some 1,500,000 persons in Central Luzon. As in other members of this group, the phonology is simple, with but three vowels and 13 consonants. The noun lacks inflection except as indicated by the form of the article and by a prefixed word meaning "all many," etc., to denote the plural. The article and the pronoun, on the other hand, show true inflection, with a dual and both an inclusive and exclusive first plural ("we, including you," "we, but not you"). The verb has two categories: "definite," much the more common, which is essentially a verbal noun with the logical object in the nominative and the logical subject in the genitive ("the house (is) the man's building" = "the man builds the house"); and "indefinite," a true verb with present, past and future tenses, also forming imperfections, pluperfects and future perfects by the use of auxiliary particles. The tenses are denoted by prefixes, but each tense is invariable within itself, requiring a noun or pronoun to designate its person and number. L. H. G.

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TAGANROG, seaport and administrative center of the Taganrog district in the North Caucasian Region of the R.S.F.S.R. It is situated on the north coast of the Gulf of Taganrog, which opens into the Sea of Azov. The city has large leather factories, a machine works and grain warehouses. Although Taganrog is usually icebound during three winter months, its three harbors export the grain, caviar, oil, butter and wool which are transshipped mainly from Rostov-on-Don. It originally was the colony of 13th century Italian merchants; Mongols later demolished this trading center. At one time it belonged to the Turks, but became Russian territory in 1769. Especially interesting is the Chékov Museum, a tribute to Taganrog's world-famous native son (*see* ЧЕКОВ). Pop. 1926, 86,465.

TAGISH, a small North American Indian tribe speaking a dialect of the Tlingit or Koluschan lin-

guistic stock, occupying the region about Tagish and Marsh Lakes, Brit. Col. Culturally they are closely affiliated with the interior Athapaskan tribes and not with the Tlingit Chilcat, their closest linguistic relation.

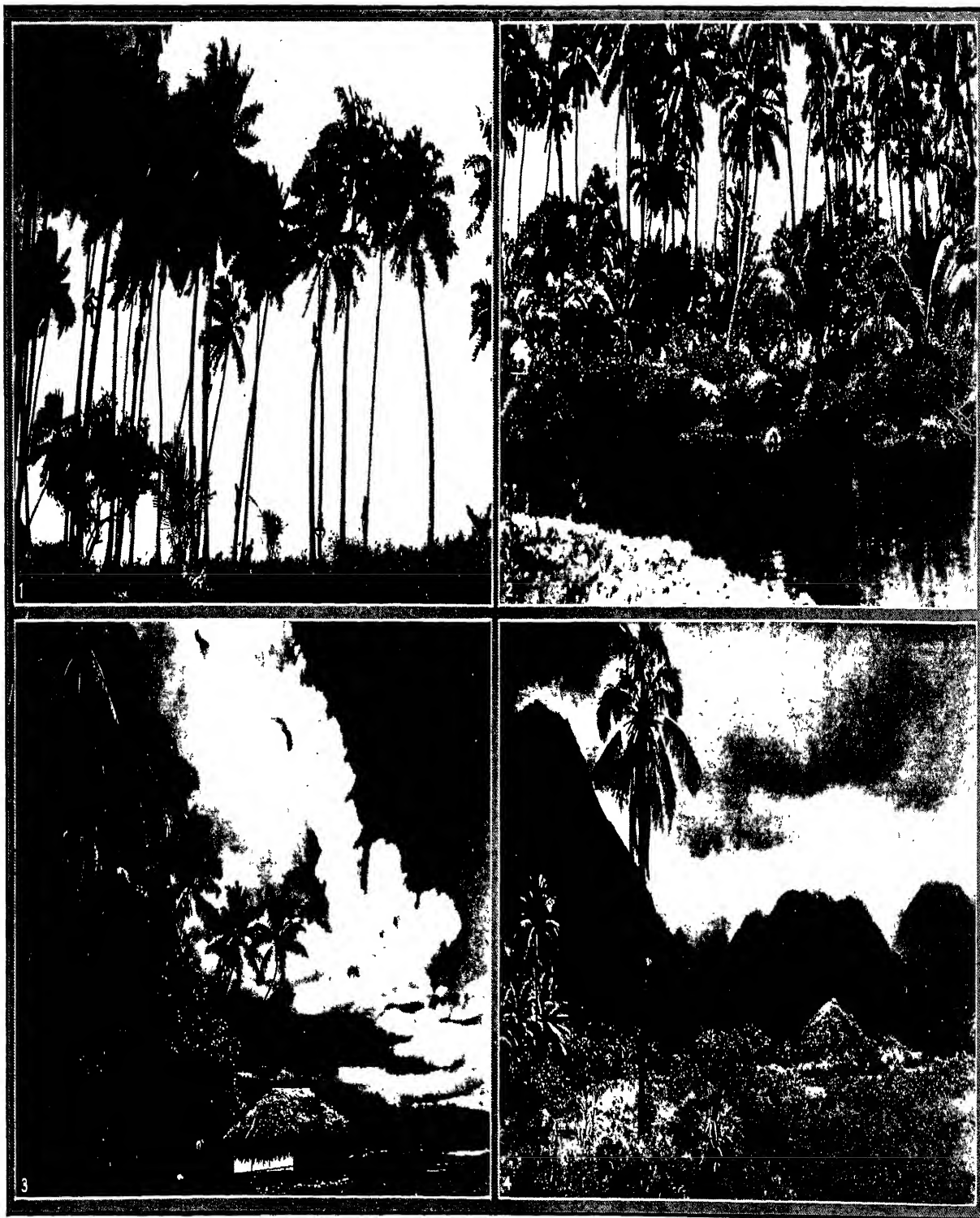
TAGORE, SIR RABINDRANATH (1861-), Hindu poet and mystic, was born in Calcutta in 1861, of an illustrious family and of a father who was revered as a mystic and saint. He was educated by his father, whom he accompanied on various expeditions and pilgrimages throughout India. After being taken to England at the age of 17 to round out his education, he returned to India and commenced a distinguished career of letters, writing in both Bengali and English and producing some 60 volumes of prose and poetry. Noted also as a musician, Tagore set over 3,000 songs to music. He founded a school for boys at Shantiniketan, Bolpur, in Bengal; toured England and the United States, lecturing at Oxford, Harvard and elsewhere; received the Nobel Prize for literature in 1913; and was knighted in 1915. He founded a World University in India, called Visva-Bharati, as an experiment in uniting Eastern and Western thought. His literary work is exemplified in collections of prose poems such as *Gitanjali*, 1912, and *Fruit-Gathering*, 1916. In 1931 Tagore published *The Religion of Man*.

TAGUS, the longest river of the Iberian Peninsula, rising in the Sierra de Albarracin, near the Aragon and New Castile boundary, with a length of about 560 mi. It receives the Jarama and Alberche rivers as principal affluents and follows a general southwesterly direction across Spain and Portugal to debouch into the Atlantic Ocean at Lisbon. For the most part it winds through fertile plains, but at Toledo the river presses tumultuously through a narrow gorge between high cliffs. Before reaching the sea the stream branches into two arms, to reunite and form the Mar da Palha, a tidal lake which gives Lisbon one of the finest harbors in southwestern Europe. For the greater part of its course the river is unnavigable. Larger vessels can proceed from Lisbon to Santarem; river navigation begins only at Abrantes.

TAHITI, an island of the Pacific Ocean, the largest of the French Society Islands. It is about 30 mi. long and covers an area of 600 sq. mi. The surface is mountainous, with fertile valleys lying between the ranges. Some of the peaks reach heights of 7,000 ft. above the sea. There is luxuriant vegetation and an abundance of fruits, such as oranges, bananas, coconuts, pineapples thrive on the soil of Tahiti. Vanilla, sugar, cacao, coffee, copra, mother-of-pearl, phosphates and rum are the chief exports. Papeete, with a population of 4,601 in 1924, is the capital. The population of the island in 1926 was 8,585.

TAHITI CHESTNUT (*Inocarpus edulis*), a tree of the senna tribe of the pea family, native to Malaya and Polynesia, bearing large edible seeds much prized by the natives for food.

TAHLTAN, a tribe of North American Indians speaking a dialect of the Athapaskan linguistic stock.



COURTESY METRO-GOLDWYN-MAYER STUDIO

TAHITI—A POLYNESIAN PARADISE

1. Natives climbing for coconuts. 2. A group of stately coconut palms.
3. A characteristic native house. 4. Typical Tahitian landscape.

They are the extreme southwestern tribal division of the Nahane Indians and live in the upper regions along the Stikine River and along the Tahltan and Tuya rivers in Alaska and British Columbia. Hunting and trapping form their chief means of sustenance. In recent years they have found profitable employment as guides for white hunters and traders. Their social organization is based on matriarchy and families are all important in their social and political life. By nature they are pleasant and hospitable and are fast abandoning their primitive ways for the comforts of civilization.

TAHOE, LAKE, a beautiful body of water in the Sierra Nevada Mountains, 12 mi. south of Truckee on the boundary line between California and Nevada. The lake is $21\frac{1}{2}$ mi. long from north to south, has a maximum width of 12 mi., is 6,275 ft. above sea level and has a depth of exceeding 1,650 ft. It fills a structural depression or dropped block in the earth's crust and is not the crater of an old volcano as is sometimes stated. The lake never freezes over. Its water is noted for clearness and purity and for its intense coloring which varies from a deep blue to a crystalline green. Lake Tahoe is a favorite center for winter sports and also one of the most popular summer resorts in California. It is reached by railroad or automobile from Truckee and other points.

TAHR, a shaggy brown goat-antelope (*Hemitragus jemlahicus*). It is native to the mountains of India and Arabia, has short, backward-curving horns, and in habits resembles the chamois, being a favorite object of alpine sport. Specimens are kept in most zoological parks.

TAIGA, the great Siberian pine forest, one of the most extensive timbered areas of the globe. The taiga stretches from the Ural Mountains to the eastern shores of Kamchatka. On the north it merges into the dwarf forests of the tundra belt, on the south into dry steppes. The zone of high-stemmed trees has an area of 45,000 geographic sq. mi. This vast, cold, in places boggy, woodland is sparsely inhabited except along the rivers. The valuable timber is frequently menaced by forest fires.

TAILINGS, in ore treatment, the waste product obtained after the valuable ore has been separated and concentrated. It is the gangue and waste rock, and is generally worthless, but is sometimes used as a filling material and for concrete.

TAILOR BIRD, the name given to various Asiatic and East Indian birds of the Old World warbler family (*Sylviidae*), remarkable for their skill in constructing nests. The best known is the Indian tailor bird (*Sutoria sutoria*) found in woods, low jungles and gardens from India to southern China. It is about 5 in. long, yellowish green above, with chestnut on the crown, and dull white below; in summer plumage, the middle tail feathers of the male are greatly elongated. The receptacle for the nest is made by stitching together the edges of a leaf, or sometimes two leaves, by means of plant fibers, the ends of which are knotted to prevent slipping. Within this

cavity is placed the nest proper, consisting of cotton, wool, hair and other soft materials. The Indian tailor bird lays three or four boldly marked, reddish or greenish eggs.

TAINE, HIPPOLYTE ADOLPHE (1828-93), French literary historian, was born at Vouziers, Apr. 21, 1828. He gave evidence of phenomenal intellectual brilliance as a boy, and it was perhaps natural that a professorial career should attract him. Later, however, literature became his sole occupation. In 1863 his *Histoire de la Littérature Anglaise* appeared and was extremely successful; for at least a generation this work was strongly influential. From 1871 till the time of his death Taine was engaged on his monumental *Origines de la France Contemporaine*. His style is glowing, vigorous and picturesque. Taine died in Paris, Mar. 5, 1893.

TAIPING REBELLION, the great outbreak against the decadent Manchu dynasty in China which swept through the central part of the country for 15 years, 1850-1864, causing enormous loss of life and property. Bitter feeling against the Manchus had been developing for many years in China. This became crystallized under the leadership of Hung Hsiuchuan who called himself God's representative, and preached a modified form of Christianity mixed with a political revolt to re-establish Chinese control in China. In 1850 the first armed clashes with the imperial forces occurred. Starting in the south and gathering adherents as they went, the rebels occupied the Yangtze Valley in 1853. From here they pushed northward and almost reached Peiping (then called Peking). In the end they failed through lack of organization and internal disagreements, partly because their increasingly wanton destructiveness turned popular feeling against them, partly because able leaders, notably Tseng Kuo-fan, came to the support of the Manchus, and partly because foreign military men organized forces to fight the rebels. This foreign participation took the form of foreign approval of the organization of Chinese forces under the command of an American, Frederick Ward, and, later, of a Briton, CHARLES GEORGE GORDON, afterwards known as "Chinese Gordon." In its later years the rebellion degenerated into guerilla warfare sweeping up and down the Yangtze Valley. It is estimated that over 20,000,000 lives were lost as a direct result of the rebellion, in addition to the destruction of thousands of towns and a score or more of large cities. Even yet the Yangtze Valley has not recovered completely from the effects of this rebellion, and the destruction of so many lives and so much property in the middle of the 19th century unquestionably very materially delayed the development of the economic and political reconstruction of China.

TAISHO TENNO (*Yoshihito*) (1879-1926), the 123rd Emperor of Japan, was born at Tokyo, Aug. 31, 1879. Ten years later he was officially declared crown prince. His father, the Meiji Emperor (*see* MEIJI TENNO) who led the modernization of Japan, took special pains to have the young prince educated along

modern lines. Yoshihito became Emperor on the death of his father in 1912, and remained the active head of the government until physical incapacity compelled his retirement in 1921, at which time his son, HIROHITO (1901-), was named to act as regent. Yoshihito died at Tokyo, Dec. 25, 1926. During his reign, called in Japanese history the Taisho Era, rapid progress was made in the industrial development of Japan, which had been started under his father, as well as in the growth of popular participation in governmental affairs through the diet. It was during this period that Japan definitely achieved her place as one of the five great powers.

TAIT, PETER GUTHRIE (1831-1901), Scottish physicist, was born at Dalkeith, Apr. 28, 1831. He went to Belfast in 1854 as professor of mathematics and in 1860 was appointed to the chair of natural philosophy at the University of Edinburgh, which he retained until 1901. His first studies were in mathematics and with Sir William Hamilton he became one of the foremost authorities on quaternions. In 1879 he turned his attention to heat, especially the kinetic theory of gases, and thermodynamics, and calibrated the thermometers and other instruments used by the "Challenger" deep-sea sounding expedition in 1860-70. With Lord Kelvin he wrote a *Treatise on Natural Philosophy*. He died at Edinburgh, July 4, 1901.

TAIWAN. See FORMOSA.

TAJAMULCO, a volcano of western Guatemala, Central America. It has a remarkably symmetrical cone which tapers to a height of about 13,800 ft. Although there have been no eruptions from it in the last century, it continues in a disturbed state. Clouds of steam issue from its summit crater and quantities of sulphur are continually deposited on its slopes.

TAJ MAHAL, a white marble tomb at AGRA, British India, erected by Shah Jahan for his favorite queen, Mumtaz-i-Mahal. One of the most perfect structures in the world, the Taj Mahal was built in the first half of the 17th century after designs by Ustad Isa and was completed at a cost of approximately \$15,000,000. It is approached through the handsome Taj Ganj Gate, a stately courtyard and a formal garden. A marble watercourse reflects the beauties of the tomb. Most magnificent at first glance is the central dome, which crowns the square-bayed edifice. Next perhaps one sees the four graceful minarets rising from the corners of the square marble platform which forms the base of the Taj. The tomb itself is built of pure white marble. Its surface is sculptured with exquisite designs in low relief and at many points the marble is studded with jewels. A mosque set on one side of the Taj and a hall on the other complete the external balance. Inside is the octagonal room which contains the tombs of Mumtaz-i-Mahal and Shah Jahan, a chamber illuminated by soft gleams of light admitted through double screens of marble trelliswork.

TAKAKKAW FALLS, a lofty fall on the Yoho River, British Columbia, occurring near Field. It is the culmination of a mountain stream which issues

from the Daly glacier and winds in a narrow groove until it leaps from the shoulder of the glacier and drops 1,000 ft. to a ledge. From this point the waters arch outward in a great curve of spray and fall 400 ft. farther to the Yoho River. The spray from the long fall is tinted with rainbow colors. The name is an Indian word meaning "It is beautiful." It is the highest cataract in the Canadian Rockies and, with the exception of those in Yosemite, the highest in America. Being fed by glacial water, the fall is at its best in the summertime. The Yoho River which receives it is in the majestic Yoho Valley, shut in by lofty, glacier-clad mountain peaks, the highest of which is Mt. Stephen.

TAKELMA, a North American Indian tribe which, together with the upper Takelma, formed a single linguistic family spoken in two dialects. Southwestern Oregon and more specifically the middle portion of the Rogue River drainage, as well as the northern branches of that river, was their former habitat. It is not known whether any Takelma are still extant on the Siletz River Reservation in Oregon where a few survivors were known in 1906. The Takelma were closely related culturally to the northern California Shasta, depending for food on the acorn, camas, seeds and berries, on salmon and other fish and on deer. Baskets were made in great variety and other utensils and implements were made of horn, bone and wood. Houses were rectangular, wooden and semi-subterranean. Their clothing was scarcely distinguishable from that of the northern Californian tribes. Their social organization was simple, the village being the important unit and the possession of wealth was the most outstanding distinction. Marriage was by purchase, usually outside the village; polygamy and the levirate were known. Rituals were connected in the main with the salmon and acorns, and shamanistic performances and the war dance were the most important ceremonial occasions.

TAKIN, a large goat-antelope (*Budorcas taxicolor*), native to the eastern Himalayan Mountains. It is clothed in shaggy hair, dull yellow to reddish-brown in color, varying with seasons. Its horns, 2 ft. long, rise from the top of the skull and bend outward, then upward, in a manner so closely resembling those of the muskox, that naturalists suspect an ancestral connection between the two animals. The takin is now very rare.

TAKLA MAKAN, a desert in central Asia, a portion of the Tarim basin which stretches westwards to the Pamirs. The Tarim basin is a pear-shaped area about 900 mi. from east to west and with a width from north to south of as much as 330 mi. By far the largest portion of this area is occupied by the huge central desert of bare sand dunes, popularly known as the Takla Makan. This is perhaps the most formidable of all the dune-covered wastes of the globe—a "true" desert as opposed to what has been called a "tame" desert (this last may in years of good rainfall become partly covered with grass or herbs, and so support life).

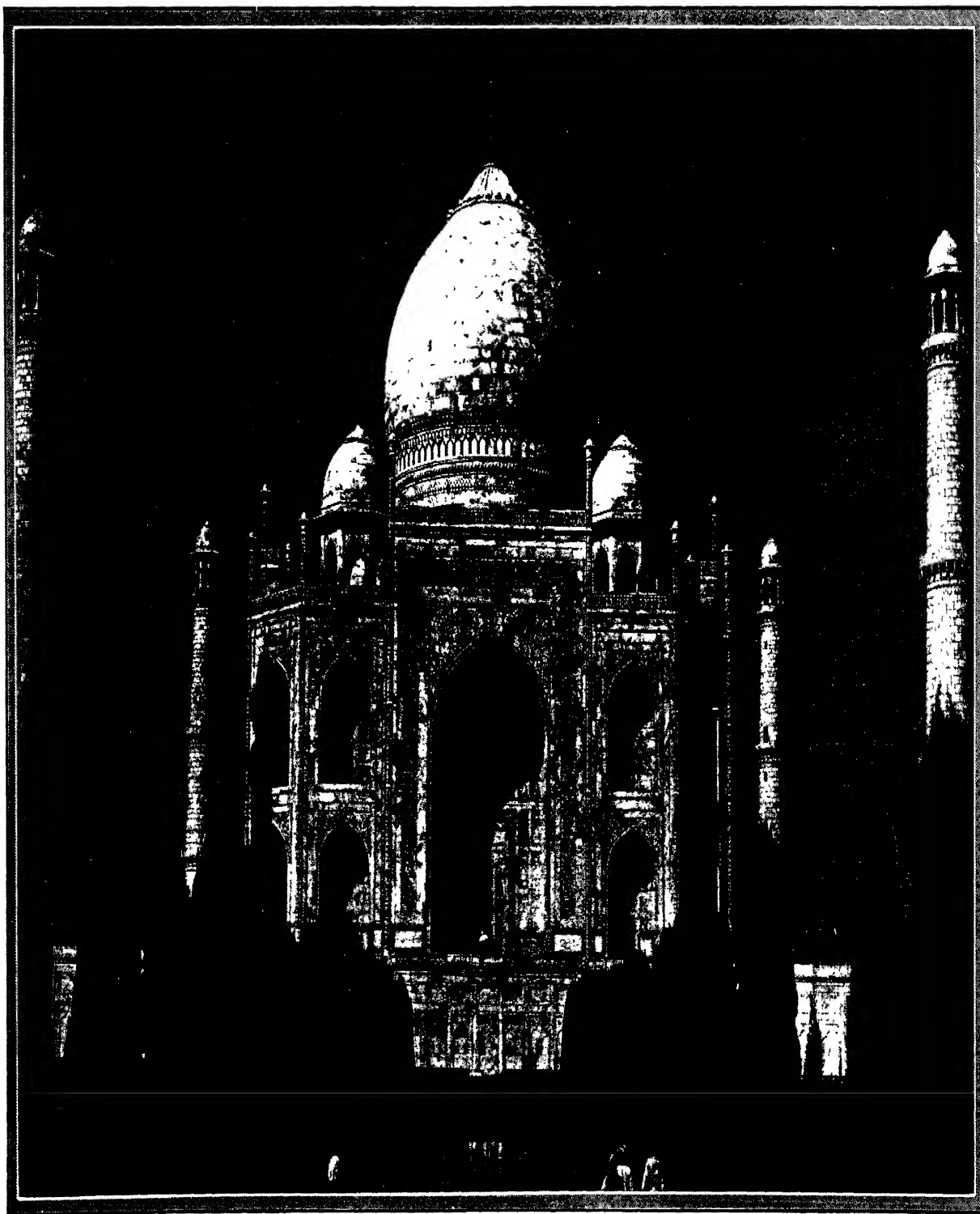


PHOTO BY R. I. NESMITH AND ASSOCIATES

THE TAJ MAHAL—THE TEMPLE OF PEERLESS BEAUTY

The great Indian monument at Agra, showing marble façade, domes and minarets and the marble watercourse lined with cypresses. In the octagonal room under the central dome is the tomb of the Emperor Shah Jahan, and of his favorite queen, Mumtaz-i-Mahal. Ustad Isa was the architect.

The drifting soil of the Takla Makan is referred to as sand for want of a better name. It consists really of fine, disintegrated particles of rock and is of the character of alluvial loess. It is very fertile in itself, and wherever irrigated is capable of producing excellent crops. Hence there is no danger of sand dunes approaching close to the irrigated fields of the basin's margin, for the moisture binds the fertile soil and thereby stops the further advance of the dunes. In addition to individual dunes whose form and position is determined by the prevalent wind direction (mainly from the northeast), there are large hill-like ridges rising to 300 ft. or more known as Davans. In general they seem to lie parallel to the old water-courses.

Not one of the numerous rivers descending from the snowy Kuenlun succeeds in making its way through the desert, except the Khotan River, and that, too, only during a few summer months. All the rest are lost in this sea of sand at a greater or lesser distance from the line occupied by the oases or the areas of desert vegetation which they adjoin. Vegetation is practically confined to steppe plants, reeds, tamarisks and poplars.

TAKU, or Takutine, an Athapascan Indian tribe, one of the Nahane group, speaking the same dialect as the Tahltan, living on Teslen River and Lake and the upper Taku River in British Columbia.

TALC, a mica-like mineral common in many METAMORPHIC and some IGNEOUS ROCKS. It occurs disseminated, in compact masses and in platy aggregates. Like MICA, talc splits easily into thin sheets, which, though flexible, are not elastic. The finger nail will scratch talc. It has a soft, greasy feel and pearly appearance and is usually translucent with a white or greenish to gray color.

The alteration of such magnesium silicates as OLIVINE, and some PYROXENES and AMPHIBOLES, produces talc, which is a hydrous magnesium silicate of uncertain crystalline form. It often forms the principal component of schistose rocks, as talc schists, or may occur in compact, independent masses, as soapstone or steatite.

Ground talc is used as a filler for paint, paper and rubber goods, and in electrical insulation. Fine grades are made into toilet powder. Soapstone is cut for slate pencils, points for acetylene burners and slabs for laundry tubs and laboratory table tops. Small ornaments are carved out of it. Most of the world's talc comes from the United States, Vermont and New York supplying talc and Virginia soapstone. Other producers are Canada, Italy and France. *See also* WEATHERING; PETROLOGY; MINERALOGY.

TALCA, a city of Chile and capital of the province of the same name, is situated in the fertile valley of the Río Claro about 150 mi. south of Santiago. It is the center of an agricultural community. Talca was demolished by earthquake Dec. 1, 1929, but in a few years was practically rebuilt. The name Talca comes from the word *Thalca*, meaning "thunder"; its people are called the "proudest in Chile." Pop. 1930, 45,020.

TALCAHUANO, a commercial and military port of Chile, situated on a peninsula, 8 mi. northwest of CONCEPCIÓN, to which it is connected by steam and electric railways. It has a good harbor protected by the island of Quiriquina, and its chief exports are agricultural products. It is to be the terminal of the proposed transcontinental railroad, from Bahía Blanca, Argentina. Talcahuano was founded in 1780 as a military post, and a government arsenal is still maintained here. Pop. 1930, 27,549.

TALCUM POWDER. *See* BATH PREPARATIONS.

TALE, in general, any fictitious story, sometimes distinguished however, from the CONTE. It is used of a popular story of perhaps unknown age that has been orally told from father to son. The ODYSSEY, for example, contains many tales, as do also the ancient Greek dramas. Oriental literatures abound in tales, the ARABIAN NIGHTS being an admirable example. Other notable tales are those by CHARLES PERRAULT and the brothers GRIMM.

TALENT, a special ability in a given direction. Thus we speak of musical, artistic and literary talents. To what extent talent is native and to what extent it is acquired is a moot question. Its actual functioning is undoubtedly the result of both factors. Just where talent ends and genius begins is impossible to say. Talent may be thought of as a middle ground between ability and genius. Talent, like intelligence, is rather an elusive trait to measure; but attempts are now being made to put its study on a more scientific basis. Seashore has analyzed musical talent and made a scale for measuring it. Meier has developed a technique for measuring talent in the graphic arts. *

The key to the study of musical talent is found in the analysis of sound on the one hand and the musical mind on the other. Individual charts are made for scoring the ability to discriminate between pitches, intensities and volumes of sound; the possession of a time sense, a sense of rhythm, and a detection of consonance. The musical mind consists of such factors as musical action, musical intellect, musical memory and musical feeling. Musical activity consists largely of skill in controlling the various sound factors, while musical feeling may be thought of in connection with musical appreciation.

In measuring talent in the graphic arts Meier has centered upon the factor of judgment as the variable about which other qualities may be grouped. The theory is that by isolating some particular element and keeping it under control it may be used as a norm for measurement. The particular quality selected is that of judgment of art appreciation and the technique developed for measuring it is known as special selection or identification. In the Meier-Seashore tests about 125 double pictures, one of which represents the true and the other the false aesthetic judgment, are used for this purpose.

BIBLIOGRAPHY. C. E. Seashore, *The Psychology of Musical Talent*, 1919; N. Meier, *Aesthetic Judgment as a Measure of Art Talent*, 1929.

TALENT, an ancient unit of weight of varying values, an Attic talent being valued at about 57 POUNDS avoirdupois; also, a monetary unit comprising, by weight, a talent of metal, usually gold or silver; the later Attic talent had a value of from about \$1,000 to \$1,200. In a general sense, *talent* is the ability, either mental or physical, of a person. *See also* WEIGHTS AND MEASURES, ANCIENT UNITS OF.

TALES OF A WAYSIDE INN, a group of narrative poems by HENRY WADSWORTH LONGFELLOW; published between 1863 and 1873. Arranged after a scheme similar to that of *The Canterbury Tales* and based chiefly on ancient and medieval sources, the tales are supposed to be told by the landlord of the old tavern at Sudbury, Mass., and his five guests, the Musician, the Poet, the Theologian, the Spanish Jew and the Student. In all there are 21 tales, divided into three parts or days, and all linked together by preludes, interludes and finales. The most noted tales are *The Saga of King Olaf*, told by the Musician, and *Paul Revere's Ride*, the first tale told by the Landlord.

TALES OF HOFFMANN, THE, an opera in four acts and epilogue by JACQUES LEVY OFFENBACH, libretto by Michel Carré and Jules Barbier; première, Paris, 1881, New York, 1882. Of Offenbach's many works for the stage, this is the only one to achieve lasting favor. The composer died a year prior to its production. He left the work unfinished and the orchestration was completed by Ernest Girard.

In genial mood, the poet Hoffmann, drinking with a group of Nuremberg students, offers to relate three of his romantic adventures, which thereupon are duly enacted: Coppélius, a devil's advocate, has constructed an automaton named Olympia with whom Hoffmann proceeds to fall in love, being eventually disillusioned only when the maker, in a rage, destroys his remarkable creation. Giulietta, an accomplice of the devil, lures Hoffmann into making love to her by means of a magic gem which was given her by Dapertutto to whom she returns as soon as Hoffmann has been beguiled into slaying her dupe, known as Schlemihl. Antonie, an innocent maiden, stirs Hoffmann's romantic sentiments by her virtues, but she soon dies in the arms of her father when, at the behest of Doctor Mirakel, an emissary of the devil, she ventures to tax her consumptive frame by singing. Having successively tried three kinds of love—love of a beautiful woman, a sensuous woman, and an innocent maiden—and having been disappointed in all three adventures, Hoffmann concludes that art alone shall hereafter be his mistress.

TALISMAN, a device which supposedly protects one from evil. Charms, amulets and talismans were distinguished somewhat in the days when they were generally believed in. Charm was the more general term and might be a word, gesture, formula or potion, as well as a precious stone or an emblematic object. The amulet was an object worn, suspended or carried on the person to protect against misfortune, against diseases particularly.

The talisman was a more elaborate device; it might

be an inscription, a religious text, an astrological sign, or some bit of cabalistic lore, which could, like the phylacteries of the Jews, be placed on door-posts, or held in possession for protection from evil. *See also* AMULET and CHARM.

TALLADEGA, a city in northeastern Alabama, county seat of Talladega Co., situated 55 mi. east of Birmingham, served by bus lines and three railroads. There is an airport near by. Iron ore, manganese, bauxite and glass sand are found in this region. The principal crops are cotton and corn. Talladega has cotton and cotton-seed-oil mills. The city is situated in the foot-hills of the Blue Ridge Mountains; near by are mineral springs and large caves, which have only recently been explored. The site was once a village of the Creek Indians whom Andrew Jackson defeated at the battle of Talladega (1813). Talladega was incorporated in 1835. It is the seat of the State Institution for the deaf and blind and of Talladega College for Negroes. Pop. 1920, 6,546; 1930, 7,596.

TALLADEGA COLLEGE, at Talladega, Ala., a coeducational institution for Negroes, was founded in 1867 by the American Missionary Association. In addition to the regular college course, training is given in a variety of industrial lines. The grounds and buildings were valued in 1931 at \$1,264,000, and the library contained 29,000 volumes. In 1930 there were 320 students, and a faculty of 60, headed by Pres. Frederick A. Sumner.

TALLAHASSEE, the capital of Florida, the county seat of Leon Co., in the northern part of the state, situated 165 mi. west of Jacksonville. Two railroads and buses afford transportation, and the Dale Mabry Airport is located here. The vicinity is fine farming and timber country. The city's chief manufacture is lumber products. The retail trade in 1929 reached a total of \$6,497,352. Tallahassee is beautifully situated on a hill. The state capitol, of Grecian design, and other public buildings give simple dignity to the city. Near this site the Spaniards built a fort, probably as early as 1638. Tallahassee became the capital of the territory in 1824, later of the state. The city has interesting associations. Charles Louis Napoleon Achille Murat, nephew of Napoleon Bonaparte, and King of Naples, is buried here beside his wife, Catherine Willis, grand-niece of George Washington. The United States Government, in appreciation of his services, gave Gen. Lafayette a tract of land which he chose adjoining the city. Tallahassee is the seat of the Florida State College for Women. Pop. 1920, 5,637; 1930, 10,700.

TALLAHATCHIE RIVER, a stream of northern Mississippi, rising in Tippah Co. It flows in a general southwestern direction and after a course of 230 mi. unites with the Yalobusha at Greenwood in Leflore Co. The combined stream is called the Yazoo. With its chief tributary, the Coldwater River, it drains about 3,500 sq. mi. of agricultural land devoted mostly to cotton raising. This river is an alluvial stream with a slow current and averages about 300 ft. in width. By moving wrecks, snags and leaning

trees the channel has been opened so that navigation is possible throughout the year to Minter City.

TALLAPOOSA RIVER, a river of Georgia and Alabama, rising in Paulding Co. in west central Georgia. Following a southwesterly course, it flows into Alabama and unites with the Coosa about 10 mi. northeast of Montgomery. The combined stream is the Alabama River. Including its many windings, the Tallapoosa is about 250 mi. long. It crosses the fall line at Tallassee where there are shoals having a fall of 60 ft. which obstruct navigation. The area drained lies between the Chattahoochee and Coosa basins and is a region largely wooded with cultivated fields at intervals. In Tallapoosa Co. the river expands into Martin Lake.

TALLEYRAND DE PÉRIGORD, CHARLES MAURICE, PRINCE (1754-1838), French statesman and diplomat, was born at Paris, Feb. 2, 1754. He came of a princely family. Being lame his rights as the oldest son were passed over, and he was educated for the Church, a career that he determined to abandon as soon as he could. His fascinating manners, wit and cynicism gave him a unique place in the society of his time. He was chosen a deputy to the States General in 1789 and soon became one of its outstanding members. As Bishop of Autun he was much interested in the Church and exercised the dominant influence in bringing about the confiscation of Church property and the civil constitution of the clergy. For this he was excommunicated in 1791.

In 1792 he was sent as special envoy to England but with the advent to power of the radicals, Talleyrand went into exile, going to America where he took out citizenship papers. In 1796 he returned to France, joined Napoleon and became his minister of foreign affairs. In this capacity he had a prominent share in the sweeping changes made by Napoleon in the state system of Europe, and was made Prince de Benevento in 1806. Three years later having quarreled with Napoleon over his Spanish and Russian policies Talleyrand resigned. With the overthrow of Napoleon, he became active in bringing back the Bourbons and served as the representative of Louis XVIII at the Congress of Vienna where he quickly won a place for France. In 1830 he was again in the small inner circle that manipulated the choice of Louis Philippe as king and was in turn sent as French ambassador to London. There he participated in the London conference on Belgian affairs, supporting the plan for Belgian independence and neutrality of which he fondly believed himself to have been the author. One of the ablest and shrewdest diplomats of Europe, Talleyrand after serving every government in France excepting the Convention and the Terror, had the satisfaction of approaching the end of his long career amid great popular esteem, forgiven by the Church and in favor with the government. He died an old, but still alert, man of 84, at Paris on May 17, 1838. W.C.L.

TALLINN (REVAL), capital of Estonia, picturesquely situated on an arm of the Gulf of Fin-

land, about 200 mi. southwest of Leningrad. The city contains many beautiful public buildings and churches and is visited by thousands of tourists every year, especially during the month of June when the annual International Industrial Fair takes place. The manufactories include textiles, cement and paper. The timber industry is considerable. The chief imports are coal, foodstuffs and cotton; the exports timber, cereals, cement, textiles and paper.

Tallinn was originally settled by the Danes. It was a member of the Hanseatic League and in the 14th century it belonged to the Teutonic Knights. Sweden and Russia successively held the city until 1918 when it became the capital of Estonia. Est. pop. 1931, 131,429.

TALLOW, a solid animal fat, obtained principally from oxen and sheep. These consist, chemically, of the glycerine esters of such fatty acids as stearic, palmitic, and oleic acid, in the ratio, approximately, of two parts of the harder and more solid stearin and palmitin to one part olein. Ox tallow is generally harder and darker in color than sheep tallow, and has less tendency to become rancid. Tallow is used extensively in the manufacture of candles and soap.

TALLOW TREE (*Sapium sebiferum*), a small tree of the spurge family called also vegetable tallow. It is a native of China and Japan cultivated in warm regions and naturalized in the southern United States from South Carolina to Florida and Louisiana. The tree grows sometimes 40 ft. high with ovate, long-pointed leaves turning red with age, and numerous small flowers in long terminal spikes. Within the fleshy, three-lobed fruiting capsules are large white seeds with a waxy tallow-like covering used for making soap and candles and also in dressing various fabrics. The name tallow tree is sometimes applied to the CANDLE-NUT.

TALMAGE, THOMAS DE WITT (1832-1902), American clergyman, was born in Bound Brook, N.J., Jan. 7, 1832, and studied at the Reformed Theological Seminary at New Brunswick. After serving as pastor of the Reformed Church in Belleville, N.J., 1856-59, at Syracuse in 1859-62 and Philadelphia from 1862-69 he was called to the Central Presbyterian Church of Brooklyn, N.Y., where he became widely known for the sensational character of his sermons. He was also a popular public lecturer and writer. He died at Washington, D.C., Apr. 12, 1902.

TALMUD, a noun formed from the Hebrew verb *limmed*, meaning to teach; but as a technical term it denotes a body of traditional teachings, oral and written, which, as they are now extant, represent a great literary product which issued from the Jewish academies in Babylonia and Palestine. In it are preserved the thoughts and opinions, the views and verdicts, the errors, transgressions, hopes, disappointments, customs, ideals, convictions and sorrows of Israel for a period of 10 centuries. Like the Bible, the Talmud is a world in miniature, embracing every possible phase of life.

The origin of the Talmud is simultaneous with Israel's return from the Babylonian exile. Israel was then a pious community with zeal for the study of its sacred Scriptures. Four different methods of expounding its text were current. They served to bring out either the simple or the symbolic, the homiletic or mystic sense of the sacred Scriptures. In the course of time two strongly marked lines of study of the Bible were developed. They are the *HALACHA*, consisting of the formulation and interpretation of the laws, and the *Haggadah*, their poetical illustration and ethical application. These two elements, the legal and the aesthetic, make up the Talmud. The *Halacha* embraces the statutes and ordinances enjoined by oral tradition, the unwritten commentary on the Bible, while the *Haggadah* also based on the text of Scriptures, only plays with it, explaining it by sagas and legends, by tales and poems, allegories, ethical reflections and historical reminiscences. However, the *Halacha* and *Haggadah* are not separate works; they are two fibers of the same thread.

The complete work of expounding, developing and finally establishing the teachings contained therein represents the labor of many generations, the method of procedure varying from time to time. Three historical strata deposited by three different classes of teachers are discernible in the Talmud. The first, the *Soferim*, or SCRIBES, flourished from the return from the Babylonian captivity to about 220 B.C. They were concerned with the preservation of the text of the Scriptures and with expounding the ordinances contained therein. They were followed by the *Tannaim* (see *TANNA*), or learners, whose activity extended till 220. Their intellectual labor produced so vast a number of injunctions, prohibitions, laws and regulations that it was necessary to reduce them to a system. One after another eminent rabbi undertook the task, and Rabbi Judah Hanasi finally succeeded. His compilation, classifying the subject matter under six heads, subdivided into 63 tractates, and containing 524 chapters is called the *Mishna*. It became the basis of further legal development and literary discussion. The *Amoraim*, or speakers, the expounders of the third period, explored its text, and for generations the *Mishna* was the sole object of their literary attention. The sum total of their literary endeavors is contained in the two Talmuds: the Talmud Yerushalmi, finished in 390, being the expression of what was taught at the Palestinian academies; the other, more important one, Talmud Babli, completed in 500, the expression of what was taught in Babylonia. The latter, regarded as authoritative, is about four times as large as the former. Its 36 treatises cover upwards of 5,000 folio pages.

The whole body of learned discussions and debates recorded in the two Talmuds forms a running commentary on the *Mishna*. These discussions, debates and investigations are the opinions and arguments of the different schools, holding opposite views, developed with rare acumen and scholastic subtlety and finally harmonized in the solution reached. The one

firm and impregnable rock supporting the gigantic structure of the Talmud is the word of the Bible, which it holds sacred and inviolable. While the Talmud does not offer a complete system of ethics, its practical philosophy consists of doctrines that underlie a moral life.

The Talmud has been described as a microcosm, embracing heaven and earth. It is a republic of literature and a library in itself. It treats of law, history, medicine, astronomy, mathematics, legend, social life, theosophy and metaphysics. It passes from myth to morality, from legend to logic, from grave to gay, from lively to severe topics. The Talmud has been compared to the sea. As the moods of the sea vary, so do those of the Talmud. There are those who have dived into its waters and brought up nothing but empty shells; others, whose searchings in its vast sea of learning have been wider and deeper, have won for themselves pearls of the finest water.

The text of the Talmud, in whole or in part, is obtainable in translations into modern languages.

J. BL.

See M. Mielziner, *Introduction to the Talmud*, 3rd ed., 1925.

TALON, JEAN BAPTISTE (1625-91), first and most outstanding *intendant* of New France, was born in Picardy. He served the French government in various civil capacities, and in 1665 arrived in Quebec as the chief instrument of royal power in New France. The duties of Talon and the eleven succeeding *intendants* included the supervision of justice and exercise of the office of chief justice in appeals; supervision of the colonial finances, and the stores and equipment of military forces. In the absence of the governor the *intendant* presided over the Sovereign Council. Since the powers of officials were rather vaguely defined, the *intendant's* exercise of jurisdiction frequently contravened that of the governor or other officials. Talon had great confidence in the future of New France, and fostered home industries which languished after his departure. He despatched prospectors in search of minerals, and was responsible for Père Dablon's report of 1670 accurately describing the resources of the Lake Superior region. He conceived and initiated a triangular trade between New France, the French West Indies, and France, but this project languished after the first vessel which Talon had built at Quebec failed to return a profit. Talon owed his appointment to his mentor Colbert, and to him regularly reported on the state of the country. In 1668 ill health occasioned his return to France; he was again in Quebec, 1670-72.

TAMALPAIS, MOUNT, a peak in Marin Co., California, 15 mi. from San Francisco across the Golden Gate. There are really three summits, West Peak, the highest, with an elevation of 2,604 ft., Middle Peak, 2,575 ft. and East Peak 2,586 ft. The mountain is easily reached by ferry across San Francisco Bay to Sausalito and thence by electric railroad or motor highway to Mill Valley, so named from an old Spanish sawmill. From Mill Valley a scenic mountain railway leads to the top which commands inter-

esting and extensive views of the surrounding country. To the south is San Francisco with Mt. Hamilton, the site of Lick Observatory, in the distance. The cities of Oakland and Berkeley can be seen across the bay and beyond them Mt. Diablo. To the north and east are the coast ranges and to the west are the Farallon Islands and the Pacific Ocean. South of West Peak, and within walking distance is Muir Woods, a forest of redwoods, some as much as 300 ft. high, dedicated to the memory of JOHN MUIR.

TAMANDUA, the lesser American ANTEATER.

TAMAQUA, a coal-mining borough in Schuylkill Co., eastern Pennsylvania, situated on the Little Schuylkill River, 15 mi. northeast of Pottsville. It is served by three railroads. Anthracite coal is mined extensively in and around the borough. Tamaqua has various manufactures, including foundry, railroad and machine shop products, powder and knitted goods. The factory output in 1929 was valued at \$3,016,115, and the retail business amounted to \$5,955,244. Tamaqua was founded in 1799. Coal was first discovered here in 1817. The town was plotted in 1829 and incorporated as a borough in 1832. Pop. 1920, 12,363; 1930, 12,936.

TAMARACK, the Indian name commonly applied to the native LARCH (*Larix laricina*) of eastern North America.

TAMARIND (*Tamarindus indica*), an elegant evergreen tree of the senna tribe of the pea family cultivated throughout the tropics as an ornamental and for its pleasantly acid fruit which has numerous uses. It is believed to be a native of tropical Africa and possibly of southern Asia, where it is extensively cultivated, especially in India. In southern Florida the tamarind is sparingly naturalized. The tree, which sometimes grows 80 ft. high with a trunk 8 ft. in diameter, bears graceful, pinnately divided leaves and fragrant yellow flowers veined with red. The fruit is a plump, slightly curved pod, 3 to 8 in. long,

with a brittle rind inclosing a soft brownish pulp in which are embedded several large glossy seeds. In many warm regions the pods and preparations made from the pulp with sugar and syrup are staple articles of commerce. Various parts of the plant are used in medicine and in cookery; a yellow dye is made from the leaves, and the timber is valuable for building purposes.

TAMARISK, a numerous genus (*Tamarix*) of shrubs and trees of the

4 to 15 ft. high, bearing twiggy branches, minute, sessile, scalelike or heathlike leaves and small flowers in narrow spikes. The common tamarisk (*T. gallica*) widespread in saline soils in Europe and Asia and sparingly naturalized from Massachusetts southward to New Mexico, is extensively planted for ornament and wind-protection. This tree, known to the Greeks and Romans as *Myrica*, is frequently mentioned in the writings of the ancients. A closely related species (*T. mannifera*), found from Egypt to Afghanistan, produces, owing to the punctures of a scale insect (*Coccus manniparus*), a white substance which falls from the twigs, believed by some to be the manna of the Bible. The jointed tamarisk (*T. articulata*) of West Asia is planted as a windbreak in the deserts of southern California.

TAMAULIPAS, a state of Mexico, situated on the Gulf of Mexico, just south of the United States border, with an area of 30,734 sq. mi. It is low and flat on the coast, but slopes to the great central plateau in the central part of the state, and to a wide plain toward the Rio Grande. It is well-watered, and has four rivers of importance: the Rio Grande, separating it from the United States, the Conchas, the Sato de Marina and the Tamesi. Tamaulipas is known throughout the world for its almost unlimited oil resources, for its vast hunting grounds, fine woods, and American progressiveness. Ships from every land are constantly arriving at its ports. Some of the products are guavas, lemons, Zapotes and other fruits, growing wild. The capital is Victoria, and other cities are Tampico, Matamoras and Nuevo Laredo. Pop. 1921, 286,904; 1930, 343,577.

TAMBOV, an industrial and cultural center in the Central Black Soil Region of the R.S.F.S.R. Founded in 1636 to protect the southeast frontiers of Muscovy from Tatar invasions, it became a thriving commercial center after losing its military leadership. Early in the 19th century a tremendous cereal trade developed there. Chief among industrial enterprises are an iron foundry, railway repair shops, flour mills and grain elevators. The most striking building is a cube-shaped cathedral with five domes built in the 17th century; there are also two excellent museums. Pop. 1926, 76,344.

TAMIL, a DRAVIDIAN language spoken by 20,000,000 persons south of Madras as far as Cape Comorin, and in the northern half of Ceylon. Its most characteristic traits are absence of simple surd consonants between vowels and retention of certain forms of *r* and *l* which have disappeared in TELUGU and Canarese since the Middle Ages. Tamil literature is one of the oldest and richest in India. Its beginnings are lost in legends, so that its most important works, which are also the earliest, cannot be dated. They include grammatical treatises, heroic idylls, Buddhist and Jaina epics, lyrics inspired by the two great Indian religious systems of Çaivism and Vaishnavism, and gnomic and ethical anthologies, of which the most celebrated is the *Kural* of Tiruvalluvar. Although SANSKRIT influence has always been felt,



F. A. RYDBERG "FLORA OF PRAIRIES AND PLAINS"

COMMON TAMARISK

tamarisk family many of which are grown as ornamentals. There are about 75 species found chiefly from the Mediterranean region to the East Indies and Japan. They are mostly low woody plants,

Tamil literature is more original than either of the other two Dravidian literatures, Canarese and Telugu.

J. B.

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TAMING OF THE SHREW, THE, a farcical comedy by SHAKESPEARE; produced about 1594. It is based principally on Ariosto's *I Suppositi* as translated by Gascoigne in *The Supposes*, 1566, and on an older play called *The Taming of a Shrew*, published by an unknown author. This swift comedy of the taming of Katherina of Padua is presented as a play given by a troupe of actors for the amusement of the loutish Christopher Sly, a drunken tinker who, in the "Induction," is tricked by a lord and his servants into believing that he is the son of a great lord. Considered as sheer farce, this domestic drama of the humbling of Kate's shrewish temper by her bold husband-and-master, Petruchio of Verona, a subjugation brought about chiefly by ridicule and in all ways complete, is perhaps unrivaled in Shakespeare, unless it be by *THE MERRY WIVES OF WINDSOR*. There is an incidental drama dealing with Kate's sister, the mincing Bianca, and her lover, Lucentio.

TAMMANY HALL, the popular name for the headquarters building of the Society of St. Tammany, New York City, and hence for the society itself. Founded as a secret society for patriotic and social purposes on May 12, 1789 and incorporated in 1805 as a fraternal aid association, Tammany Hall early developed a political character, and has become in practical effect the local representative of the national Democratic party and the generally dominant factor in city politics. Its organization as a political machine was perfected by MARTIN VAN BUREN. The society has maintained its preeminence by systematically winning the adhesion of an immense majority of the foreign born citizens and by social and philanthropic favors to the poorer classes. Increasing in complexity with the growth of New York City, the society has necessarily bestowed considerable power upon its Grand Sachem and other high officials, power which has occasionally been used to cloak speculation and corruption. The Tweed Ring, proved in 1869-71 to have perpetrated enormous frauds, was a coterie of Tammany officials. After the prosecution of Tweed the society was reorganized on a reform basis by John Kelly, whose best known successor was RICHARD CROKER, "boss" from 1888 to 1901. Its support has been of dubious value to the national Democratic party, western and southern leaders of which have bitterly denounced Tammany Hall. M. R. Werner, *Tammany Hall*, 1931, carries his account of the organization and its multifarious activities in city and state to the death of "boss" Charles F. Murphy in 1925. Its later history includes Alfred E. Smith's attempt to set a higher standard of public service within the organization.

TAMMERFORS. See **TAMPERE**.

TAM O'SHANTER, a poem by ROBERT BURNS; published 1788. Tam O'Shanter, a simple Scotch

farmer, riding homeward one stormy night from a meeting of convivial friends, sees lights burning in the weird Alloway Kirk, the reputed haunt of witches. Inquisitive and well fortified with drink, Tam goes nearer and peers inside the Kirk. Excited by the dancing of a young witch, Tam shouts his admiration, and the witches, recognizing him, rush out of the Kirk and give the poor fellow a wild chase that ends only at the Bridge of Doon, across which the unholy spirits cannot go. Few poems have so well blended the grotesque and the humorous.

TAMPA, a port city on the western coast of Florida, the county seat of Hillsborough Co., situated on Tampa Bay. Buses, steamships, two airlines and two railroads serve the city, which is one of the oldest fashionable resorts in Florida. Tarpon fishing is very popular, as are also golfing and bathing. The city is an important shipping center, its exports in 1929 amounting to \$4,202,035 tons. Havana cigars and cigarettes are the outstanding manufactures, and in 1929 some 504,753,264 cigars were turned out. The packing, shipping and canning of citrus fruits are also important industries. Phosphate is mined in great quantities. Tampa is the name of the Indian village discovered on this site in 1528 by de Narvaez. The first permanent colony was established here by the United States Government in 1823, when it built Ft. Brooke. Tampa was incorporated in 1855. Pop. 1920, 51,608; 1930, 101,161.

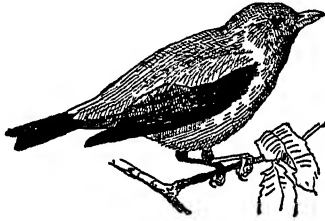
TAMPERE or **TAMMERFORS**, a city of Finland, situated between lakes Nasijarvi and Pyhajarvi, about 90 mi. northeast of Turku. It is one of the principal industrial cities of Finland, having extensive manufactures of leather goods, textiles, paper and iron. Tampere is also the seat of a bishop. Pop. 1930, 55,514.

TAMPICO, a city of Mexico, situated about 7 mi. from the Gulf of Mexico on the Panuco River. It is the most important commercial city of northeast Mexico, and in the greatest oil-producing section in the world. It is well-built, with a good lighting system, paved streets and modern street car service. Most of its industries are carried on by Americans, and are oil refining, pipe line construction and other manufactures connected with oil production. There is also an American newspaper, the *Tampico Tribune*, a Y.M.C.A., several clubs, a golf course, tennis courts and an American Chamber of Commerce. The cathedral was built in 1927 and there are several other Catholic churches, besides a Mexican Evangelical Baptist Church. Tampico stands on the site of an old fort, founded soon after the Spanish Conquest. Pop. 1921, 24,980; 1930, 70,303.

TAMPING, in blasting. See **STEMMING**.

TANAGER, the common name for a numerous family (*Thraupidae*) of small American birds closely allied to the finches. There are about 400 species found chiefly in the tropics, 4 or 5 of which migrate northward to the United States. They are mostly about 6 in. long, of compact build and brilliantly colored plumage. Arboreal in habit they usually

frequent woodlands, feeding on fruits and insects. Most tanagers are inferior songsters. The well known scarlet tanager (*Piranga erythromelas*), found widely in eastern North America and wintering from Co-



G. M. SUTTON, "BIRDS OF PENNSYLVANIA"
J. HORACE MC FARLAND CO. COPYRIGHT
SCARLET TANAGER, MALE

lombia to Peru, is about 7 in. long; the male is bright scarlet with black wings and tail and the female light olive-green and yellow. It utters a loud, cheerful, somewhat robin-like song and builds a slight, saucer-shaped nest on horizontal branches, laying three or four speckled, bluish eggs. The summer tanager (*P. rubra*), of similar habits, occurs chiefly in the southern states; the male is rose-red with brownish wings. The western tanager (*P. ludoviciana*), with red, black and yellow plumage, is found chiefly in the western states.

TANCRED, one of the great figures of the First Crusade, was a Sicilian-Norman, on his mother's side, a grandson of Robert Guiscard and nephew of Bohemund of Antioch. His father is unknown. He joined the First Crusade with his uncle but as soon as the army was well established in Asia Minor struck out for himself, capturing Tarsus. Driven from there by Baldwin of Lorraine he rejoined his uncle at the siege of Antioch. Bohemund remained behind after the city was taken, but Tancred moved on with the rest of the Crusaders and took part in the siege of Jerusalem. Later he returned to Antioch as regent for his uncle, occupied Edessa for a time and fought both the Saracens and Greek Christians. He died in 1112. The figure of Tancred has become almost legendary in western epic literature of the Crusades.

TANEY, ROGER BROOKE (1777-1864), American jurist, was born in Calvert Co., Md., Mar. 17, 1777. He was graduated from Dickinson College, and was admitted to the bar in 1799. Taney was elected attorney-general of Maryland, serving in that office during 1827-31, and in 1831 was appointed Attorney-General of the United States. In 1836 he became chief justice of the Supreme Court. Some of his rulings were questioned, notably the decision in the famous *DRED SCOTT* case which Taney wrote, but he was unquestionably one of the most able jurists of his time. He died at Washington, D.C., Oct. 12, 1864.

TANGANYIKA, a territory consisting mostly of the region on the east coast of Africa formerly known as German East Africa, and lying between the Indian Ocean and Belgian Congo. The area, 374,000 sq. mi., is a British mandate.

The forests cover about 1% of the area; the coastal forests provide mangrove, ebony, gum copal and wild rubber; bamboo is common on the highlands. Oil palms appear near LAKE TANGANYIKA. Highland products include sisal and coffee, and coastal products include cocoanuts, cotton, rice and sugar. The activity of the plantations is chiefly owing to the introduction of sisal hemp. About 4,000,000 cattle and sheep and goats in equal number are raised in the colony.

Gold and diamonds are worked, and a little high-grade mica is produced. But poor communications present difficulties in the further exploitation of minerals.

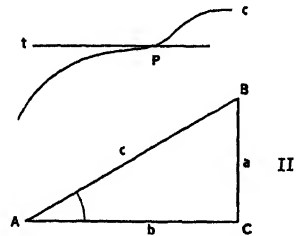
DAR-ES-SALAAM, the capital, has a good harbor, and Tanga provides an outlet for the products of important plantations in the northeast. Native occupation of interior districts is restricted because of danger of disease from the tsetse fly.

German East Africa was colonized by Germans in 1884. Captured by the British and Belgians in 1918, the territory was subsequently divided between the two countries. Pop. 1929, 4,800,630, including 6,630 Europeans, mostly British and Dutch.

TANGANYIKA, LAKE, in central Africa, extending from 3° 16' to 8° 48' S. lat., and from 29° 20' to 31° 20' E. long. Area about 13,000 sq. mi.

Tanganyika lies in a deep trough, and is the deepest fresh-water lake in the world, with the exception of the Siberian LAKE BAIKAL. Soundings of 4,190 ft. have been obtained. All the shores but those on the east coast, south of Kigoma, are mountainous. The southern end of the lake has a tendency to be salty, and the water from Lake Tanganyika escapes by Lukuga to the Congo only in very wet seasons. The lake is about 2,500 ft. above sea level.

TANGENT, a line unlimited in length which touches a circle or other conic in only one point. Similarly we may have a plane tangent to a sphere. In modern geometry the term is extended to include tangents which cut certain curves at the point of tangency. It is then defined by saying that a tangent to a curve cuts the curve in two coincident points, this serving to include the case of a tangent to a conic as well as to any other curve.



I, TANGENT CUTTING CURVE AT POINT OF TANGENCY. II, TANGENT OF ANGLE A IS $\frac{a}{b}$

In trigonometry, the tangent of *A*, in this figure of a right triangle, is the ratio of *a* to *b*; that is, $\tan A = a/b$.

TANGERINE (*Citrus nobilis* var. *deliciosa*), a small variety of the ORANGE with a characteristic luscious flavor and a delicate fragrance. It differs from the common orange (*C. sinensis*) in its flatter shape and very tender loose skin, which separates from the

pulp vesicles upon slight pressure. The tangerine is sometimes called kid-glove orange because the skin may be taken off and the pulp vesicles separated without soiling the fingers. The fruit is produced in limited quantities in California and Florida.

TANGIER, or Tanja, Africa, a seaport of Morocco at the northwestern termination of a large bay near the Strait of Gibraltar. Lying between two hills south-east of Cape Spartel it occupies an area of 225 sq. mi. Although there have been recent attempts to modernize it, Tangier consists in the main of depressing abodes and miserably foul streets. Walls encompass it and a castle and several garrisons defend it. A widespread trade is carried on, the exports being oxen, eggs, canned fish, carpets, woollens and goat skins. In 1471 the Portuguese took the town; it has since successively passed into the hands of the English, Spanish and French; finally, in 1925, it was made a neutral area. Its administration is shared by France, Great Britain and Spain. Est. pop. 1926, 60,000.

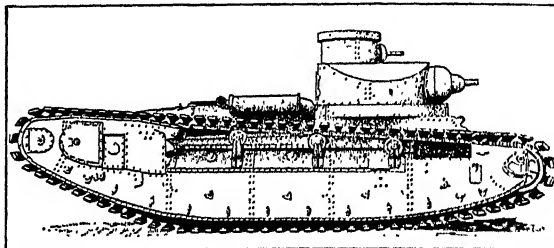
TANG SHAO-YI (1860-), Chinese republican leader, born in Kwangtung province. In 1873 he went to the United States to study and attended Columbia University, but was recalled before graduation. After diplomatic service in Korea and India, he became, in 1907, the first governor of Fengtien province when Manchuria was brought into the administrative system of China. He worked closely with YUAN SHIH-KAI, serving as his representative in 1912 in the negotiations with the republican leaders, and in the same year he became the first Premier of the republic. Before long he split with Yuan over the latter's dictatorial methods, and in 1918 he joined SUN YAT-SEN's group at Canton. He was the chief delegate of the Canton Government in the reorganization negotiations at Shanghai 1919-22. Since 1923 he has been living in retirement. In 1898-99 he took an active part in the development of coal mining interests north of Tientsin.

TANK CORPS, the branch of an army equipped solely to employ tanks in combat. The British tank corps, now called the Royal Tank Corps, was organized early in 1917. Simultaneously French tank units were formed, but as units of the field artillery and not a separate corps. The United States formed a separate tank corps in Sept. 1917. This organization was abolished in 1920 and tanks were incorporated as part of the infantry branch. Since the World War, France has also reorganized tank units as infantry. The idea that the combat mission of tanks is identical with that of infantry was the basis of the change in each case.

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TANKS, armored motor tractors travelling on caterpillar tracks and manned by crews of two or more men depending upon the size. They are provided with port holes and armed with machine guns, thus delivering a heavy fire while advancing. Their armor permits of advance under heavy hostile fire. Their length and caterpillar form of locomotion allows passage of trenches and their obstructions, as well as open

spaces covered by troops not equipped with these machines. Ordinarily artillery fire is required to halt the advance of tanks. They were first used by the British during the World War.



MEDIUM-SIZED TANK, UNITED STATES ARMY MODEL

TANNA (plural, Tannaim), a term used to designate the teachers of the Jewish Law from the time of the School of Hillel and the School of Shammai, about 10 A.D., to the time of Judah Hanasi, who completed the redaction of the Mishna about 220 A.D., and of his contemporaries. The Tannaim thus carried on their activities for a little more than two centuries. The word Tanna is derived from the Aramaic verb meaning to teach, and thus means, literally, teacher. It was a general designation for a teacher of the Oral Law; later its meaning became more specialized to designate those teachers of the Oral Law whose teachings form the content of the Mishna. The teachers who taught after Judah Hanasi and his contemporaries were no longer called Tannaim, but Amoraim.

The Halachic, or legal, and the Haggadic, or legendary and traditional, decisions and dicta of all the Tannaim form the subject-matter of the Mishna (*See TALMUD*). Usually five, or six, generations of these Tannaim are reckoned, consisting of about 270 teachers, beginning with HILLEL and Shammai and their schools and GAMALIEL I and JOHANAN BEN ZAKKAI, up to Eleazar ben Simeon and Judah Hanasi. The first four mentioned were the most prominent Tannaim of the first generation. The members of the second generation, too, were of especial importance; some of these Tannaim were Rabbi Tarfon, Eliezer of Modin, Jose the Galilean, Hananiah ben Teradion and Joseph ben Kisma. A sixth generation, extending until about 220, and sometimes called half-Tannaim, because they are not mentioned in the Mishna, consisted of Gamaliel III, Bar Kappara, Eleazar ben Jose, and Abba Areka (Rab), the pupil of Judah Hanasi and the friend of Samuel of Nehardea.

A. SH.

See Graetz, History of the Jews, 1926.

TANNENBERG, BATTLE OF, an engagement in East Prussia between the Germans and Russians, during the first year of the WORLD WAR. By Aug. 20 two Russian armies, commanded respectively by Samsonov and Rennenkampf, had crossed the East Prussian frontier, after an exhausting march. Samsonov was advancing northwest, bearing on the line Allenstein-Hohenstein, with his right a distance of

75 miles from Königsberg. Although contact was not established, he believed *Rennenkampf* was directly north, when in fact *Rennenkampf's* advance was checked on Aug. 20 by the Germans at Gumbinnen, and at the close of the indeterminate battle *Rennenkampf* continued west to a front along the line Friedland-Augerburg, his left more than 50 miles from Samsonov's right. As Samsonov continued westward, widening the gap separating him from his brother commander, Hindenburg and Ludendorff seized the opportunity to strike both flanks of Samsonov's army. Accordingly on Sept. 26 the Russian right was split asunder, exposing Samsonov's center and rear south of Allenstein. On Sept. 27 the Germans hurled a battering-ram at Samsonov's left, verging on Waplitze, east of the little town of Tannenberg. Hemmed in on both sides, scarcely 2,000 Russians escaped the German ring. Samsonov, learning of the disaster, committed suicide on Sept. 29, and *Rennenkampf*, whose army retreated eastward when it heard of the Russian defeat 50 miles south, was soon afterward dismissed for his inaction. The Germans captured 125,000 prisoners and 500 guns.

TANNHÄUSER, an opera in three acts, music and libretto by RICHARD WAGNER; première, Dresden, 1845, New York, 1859, Paris, 1861, London, 1876. Barring a juvenile venture into dramatic music, it is the third of Wagner's operas, succeeding *Rienzi* and *The Flying Dutchman*. Highly melodic though it is, the opera found little favor with the public. Although it is greatly inferior to *Die Meistersinger*, a much later labor, its theme is somewhat similar in that Tannhäuser was one of the noble Minnesingers.

The minstrel knight Tannhäuser, sated with amorous pleasure in Venusberg, the court of Venus, returns to earth just as a band of pilgrims is proceeding on its way to Rome, chanting a chorus. Touched by their piety, and remorseful over his own sins, he determines to expiate his guilt by means of suffering. At this moment Hermann, landgrave of Thuringia, and the Minnesinger Wolfram von Eschenbach come upon Tannhäuser in the forest. During Tannhäuser's sojourn in Venusberg, Elizabeth, niece of Hermann, has mourned Tannhäuser's dissipations and wanderings. Her name stirs him deeply, and he is readily persuaded to enter a forthcoming contest in song since he is promised Elizabeth's hand if he proves victorious. He therefore enters the contest of the Minnesingers. However, as they all sing of the glories of virtuous love, which seem insipid to him, he breaks forth in a hymn of praise in honor of Venus. Horrified, the other minstrels draw their swords to silence him, but Elizabeth intervenes, and he is allowed by the landgrave to proceed to Rome, asking the Pope's forgiveness. He returns after many weeks to announce despairingly that the Pope cannot forgive him until the barren staff in his hand puts forth blossoms. There is no hope for him on earth, and he intends to return to Venusberg and forget his unhappy lot in dissipation. Wolfram pleads desperately with Tannhäuser,

being successful only when he mentions the saintly Elizabeth whose name quells her lover's mad intention. But Elizabeth has died, her funeral cortège is approaching, and Tannhäuser falls lifeless beside her coffin just as a band of pilgrims, returning from Rome, bears the Pope's barren staff which has blossomed and won salvation for a repentant sinner.

TANNIC ACID or gallotannic acid is a purified TANNIN, usually isolated from Asiatic oak galls. It is a light tan-colored powder, of herblike odor, astringent taste and indicated by Emil Fischer's researches as a glucoside of GALLIC ACID. It is used in dyeing, medicines and manufacturing of writing inks.

Medicinally tannic acid is used as an astringent and to stop the flow of blood locally (hemostatic). It is also given as an antidote for many alkaloid and metallic poisons. Local applications of tannic acid either in the form of solutions or ointments have been employed for inflamed mucous membranes or on burns. Because of the very astringent property of tannic acid, it is useful for diarrhea, but is given preferably in the form of *acetyl-tannic acid* or as *albumin tannin*. These latter substances pass through the stomach relatively unchanged and exert an astringent action in the intestine.

P. N. L.

BIBLIOGRAPHY.—Perkin and Everest, *The Natural Organic Coloring Matters*.

TANNING. A great variety of substances are capable of tanning animal skin, including the natural TANNINS extracted from bark, wood and other plant tissue, salts of chromium and other heavy metals, fish oils, FORMALDEHYDE, QUINONE, silicic acid, and many sulphonic compounds. Many different kinds of chemical reactions are involved and leathers of very different character are produced, according to the type of tanning material employed and the kind of animal skin. In spite of this, it has been found possible to formulate a simple definition of tanning covering all cases.

When insoluble protein matter is brought into contact with water, it gradually becomes hydrolyzed, or broken down, into simpler materials, some of which are soluble in water. The rate of hydrolysis is greatly increased by the presence of bacteria, enzymes, acids, alkalies, and certain salts, or by rise of temperature. When a protein undergoes chemical change such that its resistance to hydrolysis under a variety of conditions has been increased, it is considered to have been tanned and the agent bringing about the chemical change is classed as a tanning material. Thus leather may be defined as animal skin whose resistance to hydrolysis has been increased by combination or interaction with any material whatsoever. Any material capable of bringing about this change is a tanning material and the reaction itself is called tanning.

There are different degrees of tanning and of tanning power possessed by different tanning agents. Thus quinone is capable of rendering skin immune to the action of boiling water, whereas fish oils give a leather which is attacked by water at temperatures above 60° C. The same tanning material gives dif-

ferent degrees of tannage according to the extent to which the reaction with animal skin is allowed to proceed. See also LEATHER AND ITS MANUFACTURE.

J. A. W.

TANNINS, a large number of substances, widely distributed among plants and capable of converting hides into leather. Quebracho and chestnut woods; hemlock, oak and wattle barks; myrobalan and gall nuts; gambier, sumac and tea leaves are some of the principal sources. For TANNING purposes, the brown to black, gummy, syrupy, water extracts are suitable, especially because the soluble "nontan" ingredients, either as such or by bacterial action, influence favorably the tanning process. For most other purposes the tannins are purified by extraction, usually with alcohol-ether mixture. The chemistry of these exceedingly complex substances is little understood. They give either blue or green solutions with iron salts, precipitate many alkaloids and dyestuffs, and most important, they absorb albumin, gelatin, starch and many proteids and glucosides to form water insoluble products of variable compositions. Recently, tanning compounds have been made synthetically. See also LEATHER AND ITS MANUFACTURE. H. R. M.

TANOAN, a North American Indian linguistic stock confined to the Pueblo Indian groups of the Tewa, Tigua, Jemez, Tano and Piro, the two latter being now extinct, and including the survivors of the population of the abandoned pueblo of Pecos. All the Pueblo villages of the Tanoan peoples are on and near the Rio Grande in New Mexico.

TANSY, a genus (*Tanacetum*) of strong-scented annual or perennial herbs of the composite family. There are about 35 species widely distributed in the Northern Hemisphere, seven of which are native to

yellow flowers in a large flat-topped cluster. Tansy was formerly widely used in medicine and is still employed as a household remedy. Among the native species are the Lake Huron tansy (*T. huronense*) found across the continent northward, and the dune tansy (*T. camphoratum*) of the California coast.

TANTA, an important city and railroad junction of Lower Egypt, lying in the center of the Nile delta, about 50 mi. north of Cairo. The town has a palace of the Khedive, and is famous throughout Egypt for its tomb-mosque of Sheikh Ahmed el Bedawi, in whose honor the largest fair in Egypt is annually held. The mosque of Ahmadi is a center of higher learning. Many thousands of Moslems make annual pilgrimages to the city. Pop. 1927, 90,016.

TANTALITE, one of the ORE minerals from which tantalum is derived, used for making filaments of electric lights. It is iron black to brown, opaque, and with a metallic to resinous appearance. Tantalite is the tantalate of iron and manganese which, by the presence of columbium, grades into columbite. It crystallizes in the ORTHORHOMBIC SYSTEM. Both minerals are found in PEGMATITES in Australia and South Dakota. See also ORE DEPOSITS.

TANTALUM, a metallic element, chemical symbol Ta, atomic weight 181.4, atomic number 73, specific gravity 16, melting point 2850° C. In the production of this comparatively rare metal, the ore (tantalite or columbite) must be brought into solution and a pure compound of tantalum, usually the double fluoride K_2TaF_7 , obtained by chemical reactions. This compound is then reduced to a metal powder by means of a powerful reducing agent such as sodium, or by electrolysis. The powder is then converted into ingots by compacting and suitable heat treatments in vacuum furnaces, this being necessary since the metal reacts readily with all of the common gases.

When pure, the metal is relatively soft and very ductile and malleable. It can be drawn into fine wire, or rolled into thin sheets at room temperatures without annealing. It is extremely inert to wet chemical corrosion. While it possesses an extremely high melting point it can be welded to itself by ordinary electric welding operations. Its chemical inertness is resulting in its application for the construction of chemical apparatus and parts of machinery working in strong mineral acids. It is one of the best metals known for the construction of internal parts of vacuum tubes. It is a very perfect electrolytic valve metal. This has resulted in its extensive use for construction of devices to charge storage batteries from an alternating current source. C. W. B.

TANTALUS, in Greek mythology, son of ZEUS, husband of DIONE and father of NIOBE and Pelops, was king of Sipylus. He displeased the gods and was punished in the lower world, being obliged to stand continually in water which receded whenever he bent down to drink; and over his head hung fruits which swayed out of his reach if he tried to grasp them.

TANOAN, a North American Indian linguistic stock confined to the Pueblo Indian groups of the



DUNE TANSY
Flowering branchlet and pinna

North America. They bear alternate, finely divided or sometimes entire leaves and usually small heads of yellow flowers. The common tansy (*T. vulgare*), widespread in Europe and Asia from the Mediterranean to the arctic circle and extensively grown in gardens, is naturalized across North America from Nova Scotia to Oregon. It is a stout erect perennial, 2 to 3 ft. high, with a strong scent and bitter taste, bearing large finely divided leaves and showy golden-

TAPESTRY



COURTESY CLEVELAND MUSEUM OF ART

FLEMISH TAPESTRY

"The Messenger," after a design by Bernard Van Orley, dating from the middle of the 16th century.

TAPESTRY



COURTESY METROPOLITAN MUSEUM OF ART

FRANCO-FLEMISH TAPESTRY

Either Arras or Tournai, both great weaving cities, produced this tapestry in about 1435 to 1440. Courtiers clasping roses, ladies and gentlemen and rose bushes are woven in wool in flat colors against a background of red, white and green stripes.

TAPESTRY



1. COURTESY CORCORAN GALLERY OF ART, WASHINGTON, D. C.

GOTHIC AND GOBELIN TAPESTRIES

1. Gothic tapestry, one of a series of four representing hunting scenes of the Duke of Burgundy. In Corcoran Art Gallery, Washington.
2. Gobelin tapestry of French court figures of the 16th century. In the Musée des Gobelins, Paris.

TAPESTRY



1. COURTESY VICTORIA AND ALBERT MUSEUM

ENGLISH AND ITALIAN TAPESTRY

1. "Jacob and Rachel at the Well," a cushion cover from the Sheldon Factory, England. In Victoria and Albert Museum, London.
2. The Resurrection, designed by Raphael, a probable 16th century Italian work, although woven in Flanders. In Vatican Gallery.

Tewa, Tigua, Jemez, Tano and Piro, the two latter being now extinct, and including the survivors of the population of the abandoned pueblo of Pecos. All the Pueblo villages of the Tanoan peoples are on and near the Rio Grande in New Mexico.

TAOISM, one of the religions of China, whose nominal adherents number about 40,000,000. Its corporate existence has depended primarily upon its temples and a priesthood, and a supreme head, called the "Master of Heaven," who, until the last "Master" was driven out by the Nationalists, resided in the province of Kang-su. The term *tao* is very ancient, and has been used with various meanings; roughly, it means "way" (the way of Heaven or of Nature that is). Taoism as such was first formulated by Lao-tze (b. 604 B.C.?), or in some manner came to be a system in opposition to practical "CONFUCIANISM." Its chief literary sources are the Book of Reason and Virtue (*Tao Teh Ching*), attributed to Lao-tze, and the writings of Chuang-tze in the 3rd century, B.C. As a system of ethics and philosophy, it emphasizes quietism after the example of the Tao itself. The Tao, nature, law, reason, but, virtually indescribable, the self-existent, self-acting, homogeneous absolute, operates quietly, humbly, self-effacingly, and through its very "non-assertion," *wu-wei*, accomplishes all things worth while. Harmony with the Tao, and the ultimate realization of the Tao is the proper goal of mankind. Obviously this higher Taoism denies the prosperity of government, educational institutions, warfare, nationalism, etc. As a religion, the emphasis is upon mystic discipline.

Ancient Taoism gave way to a more popular cult. Later Taoism has consisted of little more than magic and the occult, with only incidental continuation of the ancient teachings. The priests and nuns of modern Taoism are for the most part exorcists and geomancers. They have professed to be able to read nature and thus to determine what men's acts should be on this or that occasion from the cradle to the grave. Toward this end "wind and water," *feng-shui*, have been the peculiar basis of their interpretations. In their hands pantheistic mysticism has given way to imposition upon man's fear and credulity, and Taoism has come to represent a system of magic, possibly more pronounced in China than systems of magic anywhere else in the world. All Chinese life has been permeated with Taoist fancy; Taoist notions have been portrayed in art; poetry is full of them; the Chinese drama is profoundly Taoist; and medicine in China has owned Taoist dominance, with its charms, incantations, miraculous herbs, and drugs concocted of potent and horrible ingredients. The "Boxers" with their theory of invulnerability were Taoists. See BOXER REBELLION. J. C. A.

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TAOS, a pueblo and tribe of North American Indians speaking the Tigua dialect of the Tanoan linguistic stock. The pueblo is located on the Taos

River, an eastern tributary of the Rio Grande 52 miles northeast of Santa Fe, N.M. When visited by Coronado's expedition in 1540 and 1541 the village was located a few hundred yards northeast of its present site but then as now it was divided into two sections standing on opposite sides of the river. The tribe took an active part in the Pueblo Revolt in 1680 and in the so-called Taos Rebellion in 1847. Agriculture and hunting are the chief means of livelihood.

TAPANULI, a residency of the Dutch East Indies on the west coast of the island of SUMATRA. It comprises an area of 14,760 sq. mi. and contains the celebrated Lake Toba, which had not been seen by white men until late in the 19th century. The district is traversed by mountain ranges, some of the peaks rising to 8,000 ft. above the sea. Cattle, horses and pigs are raised in large numbers. The capital of the residency is Sibologa. Pop. 1927, 905,320.

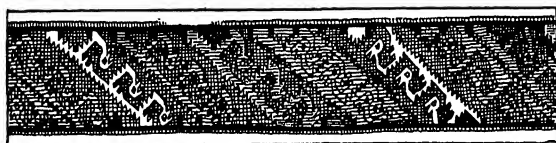
TAPESTRY, a method of weaving design in fabric and, from this, a term applied also to such fabrics themselves. Tapestry differs from embroidery in that it weaves the design into warp and weft threads in the making of the fabric, whereas embroidery sets the design on a fabric already woven. It differs from other forms of hand-weaving as markedly: in tapestry the warp threads are entirely covered by the weft; and in tapestry-weaving the weft threads of the pattern cannot be shot with a shuttle across the warp. The thread can only go so far, when it meets another color in the pattern; it must be put in on a small bobbin, carefully and loosely, by hand. This primitive method of weaving is something that cannot be done by machinery. Machine-made "tapestries" are not tapestries. Real tapestry is made to-day as it has been made for thousands of years, and its makers are of necessity artist-craftsmen.

It may be mentioned here parenthetically that the celebrated *Bayeux Tapestry* is not a tapestry: it is an exceedingly interesting piece of embroidery.

The tapestry loom is extremely simple, being little more than a frame to hold the warp threads, with a device for lifting them while the weft threads of the pattern are worked in. The large tapestry loom may stand upright (high warp) or be horizontal (low warp). The weaver works according to a colored cartoon which is fastened to his loom; and in order to manage his many threads must make his fabric wrong-side-around, seeing the right side in a fixed mirror. He must exercise not only great care, but personal ingenuity and artistic ability in his shading; and in the picture tapestries, which include the majority of tapestries, he must work skillfully with many colors: the chromatic prism composed for the Gobelines is said to contain 14,420 different tones. The high-warp method, known also by the French term of *haute-lisse*, which is used by the Gobelines, is generally considered the better, but the horizontal loom with the low warp is quicker; this is the loom used at Beauvais. In weaving tapestry open slits occur in the fabric where pattern lines run parallel to the warp, and these are treated in different ways: in the medieval

tapestries of Flanders and France they were usually sewed up after the fabric had been taken from the loom; present day tapestries are ordinarily made with some method of interlocking the pattern threads so that the open slits do not occur. As in all woven products, the number of warp threads for a given surface varies, and on this number the fineness or coarseness of the tapestry depends. The usual range is from 10 to 30 threads to the inch.

Tapestry-weaving is an ancient craft. It can be traced back to the Egyptians of the middle of the dynastic period, about 2000 B.C. The earliest specimens existing to which an accurate date can be assigned are three pieces, now in the museum at Cairo, which were found in the tomb of Thothmes IV, who reigned from 1420 to 1411 B.C. The most important "primitive" pieces existing, however, are the Coptic tapestries of the 4th to the 8th centuries A.D., and the Peruvian work of the 14th to the 17th centuries. The



COURTESY M. M. OF ART

PERUVIAN WOOL TAPESTRY OF THE PRE-INCA PERIOD (10TH-14TH CENTURIES)

Natural History Museum in New York and the Museum of Fine Arts in Boston have excellent collections of these early tapestries.

The great era of tapestry-weaving in Europe came with the Flemish development of the craft. How and when it was first introduced and adopted in Flanders is not known, although it was apparently brought from the East. By the beginning of the 14th century, however, tapestry-weaving, always an art, had become in Flanders a flourishing industry as well. During that century Flanders became a possession of the enormously wealthy and powerful Dukes of Burgundy. This event had two effects upon tapestry-weaving: it gave the art the richest possible patronage, in the Burgundian court; and brought it into close contact with France, to whose royal house the Burgundian Dukes belonged. Practically all European tapestry, after the classic culture was brought to an end by the Dark Ages, owes its origin to the Flemish weavers. Their tapestries went everywhere, as did they themselves; it would seem that from every country orders came to them. Only in France does tapestry-weaving give evidence of developing alongside of instead of after the tapestry-weaving of Flanders, probably because the two countries were so closely linked geographically and politically. In the year 1477, indeed, France captured and annexed the great weaving center of Arras, which had been the first capital of tapestry-weaving, and so intimately associated with the art that, in England especially, "tapestry" and "arras" became synonymous common nouns. After that Brussels became the great Flemish tapestry center. At the end of the 18th century tapestry-weaving was

given up in Flanders. In France the national factories of the Gobelins in Paris, and of Beauvais were founded, and the factory at Aubusson was put under royal patronage in the 17th century. The two first-named are still national factories for handmade tapestries, and are successful, renowned and working according to their traditional methods. In Aubusson there are now many private factories, and although a number of them have turned to machine-weaving, handwork is still done there also. In Germany and Scandinavia tapestry-weaving was one of the domestic crafts of the Middle Ages. In Italy, although there was fine individual work, tapestry did not become generally popular as it did in other countries. The Italian genius appears to have been better suited to fresco painting. England early brought tapestries from Flanders, and established home factories in the 16th century. Where the word "factory" is used here, it must be understood as being for handwork, not machine work.

Of the great tapestries of the 14th century there remain a few individual pieces, but only one series, the famous set of the Apocalypse in the cathedral of Angers; this was woven by Nicholas Bataille in Paris after cartoons by Hennequin of Bruges. From the 15th century onward many beautiful tapestries remain; a late Gothic masterpiece is the celebrated Mazarin Tapestry acquired by J. Pierpont Morgan, very intricate work and marvelously lifelike. Probably the most famous tapestries in the world are the celebrated *Acts of the Apostles* in the Vatican, for which RAPHAEL made the cartoons; they were woven in Brussels in the early 16th century.

The early years of the 20th century saw a notable increase of interest in tapestry-weaving in almost every country. Modern tapestries are made according both to the traditional pictorial patterns and in arrangements of pure design. Methods also are both traditional and "modified." But the age-old distinctions between tapestry and embroidery and between tapestry and other kinds of weaving, and the age-old necessity for artistic workmanship, remain unchanged.

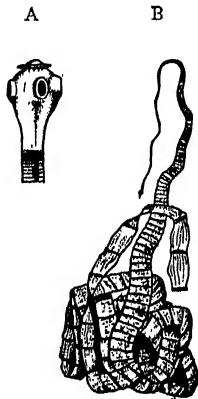
BIBLIOGRAPHY.—H. C. Candee, *Tapestry Book*, 1912; W. G. Thompson, *History of Tapestry*, 1930.

TAPEWORM, the common name for members of a class (*Cestodes*) of flatworms which are intestinal parasites, usually in backboneed animals. There are many species, ranging in size from forms about $\frac{1}{25}$ inch long to creatures which measure 40 feet. They are frequently ribbon-like or leaf-shaped. Tapeworms are without sense organs of any kind; their muscles are almost useless, their nerves are degenerate and they have no mouths or digestive tracts. Food, already partly digested by the host, is absorbed through the body wall. Most of them are hermaphrodites that fertilize their own eggs, of which they continually liberate hundreds. Their life history is generally complicated, usually involving one or more intermediate hosts in which the larvæ mature, before the final host is reached. Tapeworms are common, and not necessarily very harmful but they sometimes cause death to

poultry and cattle. They are rarely dangerous to man.

Of the tapeworms parasitic upon man there are several species. The most important ones occurring in the United States are the pork tapeworm known as *Taenia solium* and the beef tapeworm named *Taenia saginata*. The mature tapeworm may be from forty to sixty feet in length. The head of the worm is about the size of a pin head and is armed with suckers. The head of the pork worm is also supplied with hooklets. These devices enable the worms to attach themselves to the intestinal wall.

Each segment of the worm is sexually complete; that is, it contains the elements of both sexes. Only the terminal segments are sexually mature. As they become filled with fully developed eggs, the segments are discharged into the stools. If eaten by a pig or cow (the pork tapeworm can develop only in the pig, and the beef tapeworm only in the cow), the egg shell is dissolved in the animal's stomach. This liberates the embryo, which bores its way through the body until it reaches the muscles. There it forms a cyst.



HUMAN TAPEWORM (*Taenia solium*)

A, Head, magnified. B, Body tapering to head (reduced)

In adults, knowledge of the infestation may produce depression. Often there is an increase in the number of cells known as eosinophiles in the blood.

The diagnosis is made by finding segments of the worms or eggs in the stools.

The infestation may be prevented by careful inspection of meat for the cysts; sufficient cooking of the meat; and destruction by burning of all tapeworm segments passed in the stools.

The usual treatment consists in preparation of the bowel by giving a dose of castor oil on the first evening. On the morning of the second and third days a saline laxative, such as magnesium sulphate, is given, followed by cascara in the evening. On the fourth day male fern is given, followed by castor oil and then an enema if the bowels have not opened.

The stools passed after the male fern has been given must be examined for the head of the worm. If the

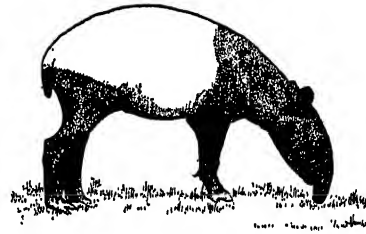
head is passed with the other segments, the worm will not re-form.

There is a type of tapeworm (*Taenia echinococcus*) that infests dogs. When the eggs of this worm are swallowed by man, the worm enters the cyst stage. This causes the development of tumor-like swellings in organs, such as the liver and brain. These cysts are found in those who associate closely with dogs. The symptoms vary with the location of the cysts. The treatment is surgical. The cysts are opened and their contents drained out. See also PARASITIC DISEASES.

W. I. F.

TAPIOCA, a farinaceous food made from the roots of the tropical cassava plant (*Manihot esculenta*). It is usually marketed in coarsely granular form and upon cooking, swells and thickens and becomes translucent. It is used chiefly in making puddings. Its colloidal properties give it other special uses in cookery. Tapioca is easily digested and nutritious.

TAPIR, a mammal of the family *Tapiridae*, somewhat intermediate in structure between the horses and rhinoceroses. Tapirs have a plump body, pony-like size and form, with stout legs; feet resting on small hoofs; long head, ending in a short, flexible trunk; and a very small tail. These animals now exist only in tropical America and the Malayan Is-



MALAY TAPIR

lands, and are the remnants of a geologically ancient and widely distributed group. All are uniformly coated with brown or blackish hair, except the large Malayan species, which is light-colored from shoulders to rump; the young are streaked and spotted with white during the first year.

Tapirs are harmless forest-dwellers, trusting to their speed and dull color for safety, being preyed upon by jaguars, great snakes, and alligators, and are hunted by men for food. They retire by day to dense shady coverts, and feed mainly at night. The American species are abundant in Central America and southward over Brazil, frequenting swamps and river-courses, where they swim well, feeding on succulent waterplants. Specimens are kept in most zoological parks.

E. I.

TAPS AND DIES, tools used for cutting screw threads in holes and on rods or other work. Taps cut internal threads, as in a nut; while dies cut external threads, as on a bolt that screws into the nut. Some manufacturers grind the threads to shape after they have been cut and hardened; others harden the

tap blank first and grind the thread complete. Both taps and dies are made either in a solid piece or with separate cutting tools, or "chasers." In many so-called collapsible taps and dies, these chasers retract after the thread is cut, allowing the tool to be pulled directly off the work without turning.

TAR, the black, viscous liquid that condenses from the volatile products obtained in the CARBONIZATION of bituminous coal, lignite, wood (*see also* WOOD DISTILLATION) or similar organic materials. The composition and yield vary greatly with the temperature and composition of the material carbonized as well as with the subsequent treatment of the volatile products before condensation. Tar contains a large number of different organic chemical compounds consisting chiefly of hydrocarbons of the aromatic, naphthene, olefin and paraffin series; tar acids such as phenol, cresols and xylenols; and tar bases as pyridine and quinoline. In the refining process these compounds are first separated by fractional distillation into groups of successively higher boiling ranges. The following groups, which apply to coal tar, illustrate the process for other types of tar, even though the fractions have a different composition:

(1) Light oils, b.p. up to 170° C.	2 to 5%
(2) Middle or carbolic oils, b.p. 170° to 230° C. . .	8 to 12%
(3) Heavy or creosote oils, b.p. 230° to 270° C. . .	8 to 12%
(4) Anthracene oil, b.p., 270° to 350° C.	10 to 20%
(5) Pitch or residue from distillation	45 to 60%

By further treatment of these fractions with acid and alkali, the pyridine, carbolic acid and higher phenols are separated from the hydrocarbons and neutral oils, which by suitable chemical and physical processes may be resolved into their individual chemical components, of which naphthalene constitutes ten per cent and phenanthrene four per cent of the total tar. (*See also* COAL TAR.)

Tar from the distillation of hardwood, consisting chiefly of hydrocarbons, phenols and acids, is mostly used for fuel at the distillation plants, but tar from pine wood contains in addition, terpenes and resins. On refining, it yields turpentine, rosin oil, pine oil, pine tar, creosote and pitch. Pine oil is extensively used in the FLOTATION PROCESS for ores. (*See also* ORE TREATMENT.)

German brown coal tars contain neutral oils similar in composition to paraffin-base petroleum and on refining yield similar products in addition to phenols and cresols.

For special tar tests *see* TAR TESTING. A. C. F.

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TARANTO, a seaport of southeastern Italy, situated on the northern shores of the Gulf of Taranto. It is the seat of an archbishop. The crowded old city is on a rocky island and the new city, the Citta Nuova, grown up in recent years, is on an eastern tongue of land. It has a fully protected naval harbor and a very large commercial harbor with modern

facilities. There is a citadel, an ancient aqueduct, with other classic remains, a cathedral of the 11th century, an early Christian basilica, an old Church of San Domenico, a museum of antiquities and various educational institutions.

Tarentum, as it was anciently known, was said to have been founded by Greek colonists about 708 B.C., and was named for Taras, a mythical character, the son of Poseidon. It quickly became a flourishing settlement of great commercial, military and naval importance. Neighboring tribes, and, finally Rome, fought with it, and despite aid from Greece, the Romans conquered the city in 272 B.C. Under the emperors it became prosperous again. Taranto was part of the lower Italian kingdom in Norman times and later a feudal principality. It became a part of the kingdom of Italy in 1861. The ancient Tarentum was widely known for its purple dye, its wool, said to be the finest in all Italy, and its fruits, figs and wine. The people are now engaged in ship-building, cultivation of oysters and clams, fruit and honey. Pop. 1931, 105,946.

TARANTULA, the common name for a species (*Lycosa tarantula*) of wolf spider (*Lycosidae*), about $\frac{3}{4}$ of an inch long, found in Italy. It lives in a silk-



GIANT TARANTULA (*Hornoeumna* sp.).
Body $2\frac{3}{4}$ in.; leg spread 7 in.

lined burrow in the ground, and in the winter it hibernates, walling itself in with silk. The females keep their egg cocoons in their burrows, and take them with them when they go hunting. Many spiders much larger and more virulent than *Lycosa tarantula* are commonly mis-called tarantulas.

In the Middle Ages the bite of a tarantula was believed to cause a disease called tarantism, but in reality they are no more poisonous than other equally large spiders. *See also* SPIDER.

TARBELL, EDMUND C. (1862-), American painter, was born at West Groton, Mass., Apr. 26, 1862. He studied at the Boston Museum School and with Boulanger and Lefebvre in Paris. Upon his return to America he settled near Boston and attracted attention by his New England interiors. His painting shows the influence of the Impressionists. He became a member of the National Academy and of the so-called Ten American Painters, and in 1889

became an instructor in drawing and painting at the Boston Art Museum. Among his best known paintings are *Josephine and Mercie*, Corcoran Gallery, Washington; *Women in Pink and Green* and *Girl Reading*, Cincinnati Museum; *The Venetian Blind*, Worcester Museum; *The Golden Screen*, Pennsylvania Academy, Philadelphia; and *Girl Reading*, Boston Museum.

TARBELL, IDA MINERVA (1857-), American author, was born Nov. 5, 1857, in Erie Co., Pa. After graduation from Allegheny College she studied four years at the University of Paris and the Collège de France. She has written biographies and historical and economic studies. Among her most important works are her *Life of Abraham Lincoln*, *In the Footsteps of Lincoln* and *Life of Judge Gary*.

TARBES, a city of southern France, capital of the department of Hautes-Pyrénées. In the Middle Ages it was much fought over as the capital of the county of Bigorre. Tarbes is a thriving industrial town, its chief manufactures being pottery and railway material. It is well known as a horse-breeding center. Marshal Foch was born here, Oct. 2, 1851. Pop. 1931, 32,374.

TARBORO, a town in eastern North Carolina, the county seat of Edgecombe Co., situated on the Tar River 71 mi. east of Raleigh. It is served by the Atlantic Coast Line and the East Carolina railroads. Tarboro is located in a cotton and tobacco growing region and is an important trade and manufacturing center. The industries include cotton-seed oil mills, cotton gins, knitting mills, fertilizer factories, cotton mills and lumber and wood products factories. Pop. 1920, 4,568; 1930, 6,379.

TAR-BOUND MACADAM. See **MACADAM ROADS**.

TARDENOISIAN CULTURE, the stage of culture belonging to the period of transition between the Old Stone Age (see **STONE AGE**) of chipped flints and the New Stone Age of polished flints; it blends with the Azilian culture. This culture dates from 15,000 to 17,000 years ago. The Tardenoisian culture represented by discoveries at Fère-en-Tardenois, in the department of the Aisne, northern France. The name Tardenoisian is particularly given to the pigmy flint implements found at this site and at many other places in Europe, as well as in Palestine, Syria, India and Egypt. The pigmy flints are triangular, four-sided, or segments of circles, generally less than an inch long. They are supposed to be arrow points, or to have been the teeth of sickles and harpoons. Harpoons with flint teeth of this type have been found in the peat mosses of Denmark. A gradual development of flints of Tardenoisian types is found in north Africa, whence this culture appears to have come into Europe. The name microliths is given to the pigmy flints of geometrical pattern of the Tardenoisian type; their use as harpoon barbs extended over a wide area. See **ARCHAEOLOGY**.

TARDIEU, ANDRÉ PIERRE GABRIEL AMÉDÉE (1876-), Premier of France, was born

at Paris, Sept. 22, 1876. He was educated at the Lycée Condorcet and the École Normale Supérieure. In 1897 he was an attaché at Berlin, and from 1898 to 1902 secretary of the Council of Ministers. After serving as High Commissioner of France to the United States, he became Minister of Liberated Regions and French plenipotentiary at the Peace Conference, 1919. From 1926 to 1928 Tardieu was Minister of Public Works, leaving this post to become Minister of the Interior. He became Premier in 1929, a post which he held until December of the following year, when his cabinet was ousted because of a bank scandal involving the government. In 1931 Tardieu held the offices of Minister of Agriculture, Minister of the Interior and in 1932, Minister of War. He again became Premier in Feb. 1932, but was succeeded by Herriot next June.

TARENTUM, an industrial borough in Allegheny Co., southwestern Pennsylvania, situated 21 mi. north east of Pittsburgh, on the Allegheny River. It is served by the Pennsylvania Railroad. Coal and natural gas are plentiful in this vicinity. The principal local industry is glass manufacture; steel tubing, sheet steel and paper are also produced. Pop. 1920, 8,925; 1930, 9,551.

TARENTUM. See **TARANTO**.

TARGET PRACTICE, the phase of rifle marksmanship training which includes firing on the range (see **MARKSMANSHIP**). A specially constructed range with targets at marked distances of 200, 300, 500, and 600 yards from firing points is used. This type of range is called a Class A range to distinguish it from one used only for combat firing, designated Class B. Target practice consists of instruction practice and record practice, the latter being a test for determining marksmanship qualification. Gallery practice in which subcaliber rifles are fired on a miniature range usually indoors, is a beneficial and economical means of preparing men for the regular practice on the Class A range.

TARGET PRACTICE, NAVY. See **GUNNER TARGET PRACTICE**.

TARGUM, a term of Babylonian origin, etymologically the same as our "dragoman," and meaning translation. In its narrower sense it is applied to the Judeo-Aramaic version of the Bible, and is used even to designate the Aramaic portions of Daniel and Ezra. With the gradual decline of the Hebrew as a spoken language the need of a translation in the Aramaic vernacular made itself felt in school and synagogue. Toward the end of the pre-Christian Era written Targumim began to appear. Oral translation is considerably older. Such oral translation, given by each individual teacher, was more of a paraphrase and homiletic and legalistic expansion than a literal translation. Such uncontrolled translations were bound to lead to the dissatisfaction of the religious authorities. An official version became necessary. Yet an authoritative Targum of the Pentateuch did not appear before the early part of the 3rd century. The Pentateuch, of all other Biblical books, was natural the most important, both as containing the laws and

doctrines of Judaism, and because its reading formed a part of all public worship. Therefore the leaders of Babylonian Jewry edited the Targum to the Pentateuch, cutting out all expansions and making it as literal a translation as the Greek version of Aquila was. It is for this reason that this Targum came in later ages to be called Targum Onkelos, the last name being a corruption of Aquila.

Alongside of the official Targum Onkelos we have also an unofficial Targum to the Pentateuch, called Targum Yerushalmi, or Targum Jonathan, which is less literal than the former. As the name Jonathan is the Hebrew equivalent of the Greek Theodotion, the name may imply that this Targum is of the nature of the Greek version of Theodotion. There is also a collection of fragments the relation of which to the complete versions is doubtful. The Targum to the Prophets is attributed to Jonathan ben Uziel, a pupil of Hillel (last half of the 1st century B.C.). This Targum was also edited in Babylonia, and while trying to be literal, is nevertheless a little freer than Onkelos, in keeping with the language and subject matter of the prophets. There was also an unofficial Targum to the Prophets still known in the early Middle Ages; but only fragments have reached us. The Hagiographa, not having been used in public worship, never had an official version. The Targumim to these books are of later origin, and the various books differ in authorship, language and method. The Targum to Canticles has considerable expansions; and a second Targum to Esther is really an hagadic midrash. With the exception of the Targum to Proverbs, which is written in a dialect more Syriac than Judeo-Aramaic, the language of the Targumim is Palestinian Aramaic with more or less admixture of Babylonian Aramaic. The books of Daniel, Ezra and Nehemiah have no Targum. C. L.

BIBLIOGRAPHY.—The Targum is printed in all polyglots and rabbinic Bibles. Among special editions are to be noticed: J. Wilkins, *Targum to Chronicles*, 1715; Lagarde, *Prophetæ Chaldaice and Hagiographa Chaldaice*, 1872, 1873; A. Berliner, *Targum Onkelos*, 1884. An English translation of the three Targumim to the Pentateuch was published by J. W. Etheridge, 1862, 1865. Further information on the Targum is contained in most of the Introductions to the Bible.

TARIFA, a city in Spain in the province of Cádiz, situated on the Strait of Gibraltar. The city has old walls and towers, a Moorish citadel and a Gothic church. Its inhabitants engage in orange growing, tanning, anchovy and tunny fishing. Tarifa is named after the Berber chief, Tarif ibn Malik, who first landed in Spain. Est. pop. 1929, 12,000.

TARIFF. See CUSTOMS DUTIES; FREE TRADE AND PROTECTION.

TARIFF ACTS, UNITED STATES. The adjustment of taxes on imports so as to foster or benefit certain industries is a so-called "implied power" (nowhere specifically expressed in the Constitution) of the National Government. Theorists of the major political parties have generally agreed that protective tariff laws are properly enacted under the express

powers of the National Government to raise revenue and to regulate foreign commerce; but the extent of protection has been a partisan issue of greatest importance.

Tariff of 1789. Provision for raising revenue was the most immediate problem of the Federal Government at its inception. On Apr. 3, 1789, even before President Washington had been inaugurated, Representative James Madison moved a duty on imports. Protectionist sentiment and local interests were at once manifested. A seven weeks' debate ensued, concerned chiefly with the rates to be imposed on molasses, distilled spirits, iron and steel, hemp, nails, cotton and candles. A producing district urged special consideration for its commodity; purchasing districts were opposed to high rates. The duties as finally fixed, including a number of specific duties, set an average rate of 8½% ad valorem. The act of July 20, 1789, in addition to its recognition of protection, established the principle of discrimination against the shipping of foreign countries and in favor of domestic shipping; levied tonnage duties; and granted drawbacks on the exportation of goods imported. Shortly afterward a measure establishing machinery for collection of customs was enacted, largely based upon the laws of New York, the state which had the largest amount of foreign trade during the Confederation.

Tariff of 1792. All articles not enumerated in the first national tariff, which under that act were assessed a 5% ad valorem duty, were advanced to 7½%. In 1797 the increase was discontinued.

Acts of 1804, 1807 and 1808. These acts, affecting particular schedules, repealed the duty on salt, removed cotton manufactures from free entry to 17½% ad valorem, and increased the assessment on most important commodities.

Act of 1816. The customs revenue in 1816 reached a figure not attained again until 1850; imports in that year were valued at \$147,000,000, as against \$13,000,000 in 1814. The increase was mostly from England, whose manufacturers took advantage of the restoration of peace to flood the American and other foreign markets. Meanwhile American manufactures had developed. President Madison in Dec. 1815, affirmed the necessity of revising the tariff for the protection of American "infant industries," agriculture, trade and navigation. The bill presented by William Lowndes, chairman of the House Ways and Means Committee, and supported by Clay and Calhoun, was enacted Apr. 27, 1816; it adopted protection as the fundamental basis of the customs system, subordinating revenue to industrial needs. The system of minimum valuation was introduced, in the provision, designed to exclude cheap fabrics from the East Indies, that all cotton goods of smaller original cost than 25 cents per square yard should be assessed as of that 25-cent value. High duties on woolen and cotton goods were aimed to protect the new textile industries in the United States from English competition. New England, where maritime

TARIFF ACTS

commerce was still most important, cast 20 votes in the House against the measure; compensatory support came from the southern states, whose representatives cast 23 votes for the bill and 34 against it.

Act of 1824. Impelled by the decline of the Treasury balances consequent upon the Panic of 1819, Secretary of the Treasury Crawford urged in successive reports a revision in the tariff to increase the revenues, and also to afford more effective protection to domestic textile and iron industries. The issue of protection, linked with internal improvements, became increasingly involved in national politics. The tariff act of May 1824, calling for a general revision upward, was effected by an alliance of the West and the Middle States. Clay was its most conspicuous advocate; Webster, on behalf of the maritime interests of New England, opposed the bill. The South, committed against protection in the years since 1816, was almost solidly opposed. The act was the first to grant protection to raw wool; the principle of minimum value was extended to woolen goods; hemp was given protection, in the interests of Kentucky growers. Inconsistencies in the duties on woolens and fraudulent undervaluation of goods by European shippers, however, militated against the protective intent of the bill.

Tariff of 1828. The tariff was a predominant issue in the national campaign of 1828. Of the three most likely candidates for the presidency, Clay and Adams were committed to protection, Jackson less specifically so. Elements in the House favorable to Jackson, resorting to intrigue, decided to report a tariff bill protective in character but carrying such high duties on raw materials and naval stores as to be oppressive to New England. The effect of this tariff bill they foresaw would be that Congressmen from New England and the southern states would unite to defeat the bill, Clay and Adams would suffer loss of prestige in the West, and Jackson, not in Congress, hence under no compulsion to commit himself, would be in a strategically favorable position. The Committee on Ways and Means accordingly recommended high duties on iron, woolen goods of the sort used largely by slaves in the South, the doubling of the duty on molasses, and the omission of the customary drawback on exported rum distilled from imported molasses. This **TARIFF OF ABOMINATIONS**, however, was enacted, protectionist sentiment in each branch of Congress being sufficient to carry the bill by a narrow margin.

Tariff of 1832. The necessity of revising the Tariff of 1828 was recognized by most statesmen. Clay, having elaborated the theory of the **AMERICAN SYSTEM**, was the sole conspicuous exception. After diverse recommendations had each failed of sufficient support, Adams, as chairman of the House Committee on Manufactures, was asked to draw up a bill. The act passed July 14, 1832, closely based on his report, abolished the system of minimum valuation; reduced the duties on hemp and iron; placed low quality flax and wool on the free list; and in general

restored the protective system to its position in 182. South Carolina, strongly committed against protection as a reaction to the Tariff of 1828, was not appeased and attempted active retaliation (*see NULLIFICATION RIGHT OF*).

Tariff of 1833. As a response to the Nullification controversy unexpected by Carolinians, the House Ways and Means Committee on Dec. 27, 1832 recommended substantial decreases in duties. Sponsored by Clay, the compromise act passed Feb. 26, 1833 provided that, beginning nine months after its enactment all duties in excess of 20% should be gradually reduced until in 1842 a maximum of 20% should prevail. The intention of the graduation was to permit capital and labor to adjust themselves to the change.

Tariff of 1842. The Whig party secured the enactment, Aug. 30, 1842, of a highly protective measure, in general increasing duties to the level of 1832. Specific duties were assessed wherever practicable; domestic iron industries were particularly favored. Southern interests were lukewarm in opposition because of the immediate necessity of additional revenue.

Tariff of 1846. The Democratic party in 1846 had seemed to commit itself to the level of protection in the Tariff of 1842; Pennsylvania in that belief voted for Polk rather than Clay. The party set about revision, however, spurred by an excess of Treasury receipts in 1845, and passed a free trade bill practically as drafted by Secretary of the Treasury Robert J. Walker. Its plan was that "no duty shall be imposed on any article above the lowest rate which will yield the largest amount of revenue," and levied its highest rates upon luxuries. Articles were grouped in schedules and assessed as follows: (A) distilled spirits, 100%; (B) spices, preserved fruit and meats, tobaccos, 40%; (C, D, E, F) the greater bulk of commercial products, assessed at 30%, 25%, 20% and 15% respectively; (G) books, watches, diamonds, building stone, 10%; (H) certain manufactured products, 5%; (I) copper ore, coffee and tea free. The adoption of an *ad valorem* system produced extensive frauds, which subsequent acts for the appraisement of goods attempted to correct.

Tariff of 1857. To reduce the revenue, a measure was enacted on Mar. 3, 1857, taking the schedule of 1846 as a basis and reducing the duties approximately 5%. The free list was enlarged.

Act of 1861. The tariff of 1857 led to a large deficit in the national income, and the act of 1861 was introduced as a protectionist measure. *See MONETARY TARIFF.*

Act of 1862. To compensate for the new duties upon domestic manufactures and industries, the tariff schedules were revised to afford greater protection. Internal revenues were the chief source of Treasury supply during the Civil War.

Act of 1864. The average rate on dutiable commodities was increased from 37.2%, under the act of 1862, to 47%; internal revenue taxation was simultaneously increased.

Act of 1870. Annually increasing balances in the Treasury strengthened a demand for reduction of duties. In 1870 a comprehensive bill was proposed, but met procrastinating opposition from protectionist interests, and ultimately parts of the tariff measure were appended to an internal revenue bill which became law July 14, 1870. Articles in which domestic industry had little interest, such as tea, coffee, wine, sugar and molasses, were assigned lower rates.

Act of 1872. A 10% horizontal reduction was effected, and tea and coffee were placed on the free list, together with a number of raw materials entering into domestic manufactures.

Act of 1875. After the Panic of 1873 revenues declined sharply. The 10% horizontal reduction, in part responsible for the decline, was repealed.

Act of 1883. In 1882 President Arthur appointed a Tariff Commission of leaders in manufactures, commerce and agriculture. Despite its protectionist bias, the commission recommended average reductions of from 20 to 25%, reductions to apply to articles of necessity and to raw materials rather than to luxuries and to manufactured goods. In Congress, however, protectionist influences secured modifications toward high, and in some cases increased, protection. Duties were raised on iron and steel, and on many classes of woolen and cotton goods. The advances followed no general principle, and reflected the preponderant influence of particular interests.

Tariff Acts of 1890, 1894, 1897, 1909 and 1913. *Act of 1890.* See MCKINLEY TARIFF. *Act of 1894.* See WILSON TARIFF. *Act of 1897.* See DINGLEY TARIFF. *Act of 1909.* See PAYNE-ALDRICH TARIFF. *Act of 1913.* See UNDERWOOD TARIFF.

Act of 1921. At the insistence of a Farm bloc of western and southern congressmen, an Emergency Tariff Act was passed for protection of agricultural products. Dumping of products on the American market at prices lower than those prevailing abroad was prohibited. *Ad valorem* duties were to be based on the export value at the port of entry, whenever that value was above the value in the foreign market. Duties of 35 cents a bushel on wheat, and increasing specific assessments on other principal agricultural products, were included.

Tariff Acts of 1922 and 1930. *Act of 1922.* See FORDNEY-McCUMBER TARIFF. *Act of 1930.* See HAWLEY-SMOOT TARIFF. E. D. B.

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TARIFF COMMISSION, a board set up by the United States Government to aid in the preparation and enforcement of proper tariff measures. It has become generally recognized that it is as difficult for legislatures to enact sound tariff laws as it is for the administrative branch of the government to enforce them successfully. Expert assistance is necessary. It is for this reason that resort has been had to so-called tariff commissions. They may be per-

manent or they may be brought into existence for special emergencies. They may exist merely for the collection of data; or, in addition, may have the power to recommend certain specific measures; or may even be empowered to assume certain functions in the administration of the law.

The United States has had experience with three such boards. The first was created in 1882 to make recommendations for the tariff revision of 1883. The second was appointed by President Taft in 1909 to ascertain what countries, if any, were discriminating against American exports to such an extent as to warrant the application of the maximum rates provided in the tariff at that time. In 1916 the present commission was brought into existence. This is a permanent body of six members, not more than three of whom shall belong to the same political party. The commission has extensive powers of investigation. The following list gives an idea of the wide range of topics that may be investigated: Effects of the customs laws, relations between the rates on raw materials and those on partly finished or finished goods, relative effects of *ad valorem*, specific, and compound duties, arrangement of schedules, classification of commodities, relation of the tariff to revenue, tariff relations between the United States and foreign countries, commercial treaties, effects of export bounties, preferential rates, tariff alliances including the Paris Economy Pact, volume of importations and foreign competition including DUMPING and the Cost of PRODUCTION.

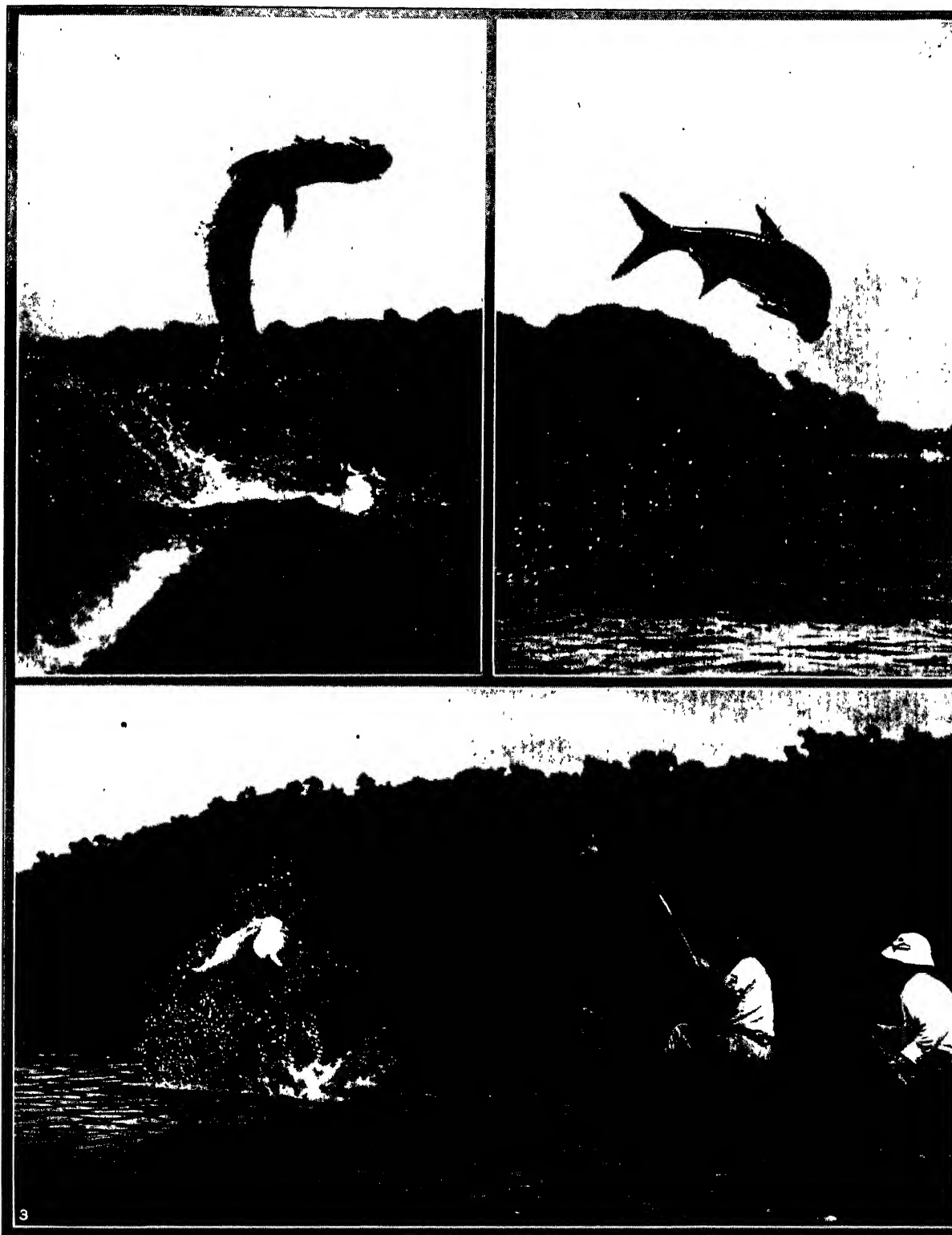
As originally created, the commission had few duties beyond the collection of data. In the Act of 1922 it was given additional powers in connection with the flexible provisions of that act. These were continued and extended in the Act of 1930. These provisions give the President power to change the rates not more than 50% if necessary to equalize costs of production, to prevent unfair competition, or to secure more favorable treatment of American goods in foreign countries. The Tariff Commission has the duty of ascertaining the cost of production and of making recommendations as to the extent to which the statute rates should be modified. Its recommendations are not binding on the President, however, and have as a matter of fact been occasionally disregarded. A. F. L.

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TARIFF DUTIES. See CUSTOMS DUTIES.

TARKINGTON, BOOTH (1869-), American novelist and playwright, was born in Indianapolis, Ind., on July 29, 1869. He was educated at Phillips Exeter Academy, and Purdue and Princeton universities. His first novel, *The Gentleman from Indiana*, 1899, depicting life in a small American town, was immediately successful. Thereafter Tarkington produced a steady stream of popular novels and plays. He showed considerable insight and a charming sense of humor when dealing with typical, contemporary Americans, as in *The Conquest of Canaan*, 1905, *The*

TARPON FISHING



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THREE VIEWS OF TARPON FISHING

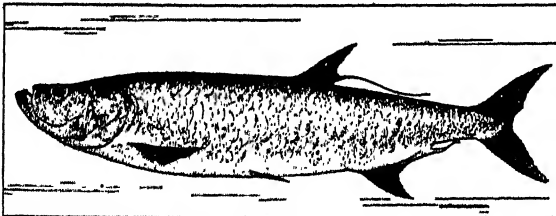
1. A tarpon jumping clear in effort to dislodge the fisherman's hook by somersaulting. 2. Another view of the

"silver king" in a spectacular leap in Florida water. 3. Near the finish. The tarpon is exhausted.

Turmoil, 1915, *The Magnificent Ambersons*, Pulitzer Prize Novel in 1918, *The Midlander*, 1924, *The Plutocrat*, 1927, and *Mary's Neck*, 1932; and proved himself expert in the psychology of women in *Alice Adams*, Pulitzer Prize Novel in 1922, *Gentle Julia*, 1922, *Women*, 1925, *Claire Ambler*, 1928, and *Young Mrs. Greeley*, 1929. That he could also do a romantic theme excellently well was early demonstrated in *Monsieur Beaucaire*, 1900. But perhaps Tarkington's most characteristic books are his humorous stories of childhood and adolescence, *Penrod*, 1914, *Penrod and Sam*, 1916, *Seventeen*, 1916, and *Penrod Jashber*, 1929. His more notable plays include *Mister Antonio*, 1916, *Clarence*, 1919, *Magnolia*, 1923, and, in collaboration with Harry Leon Wilson, *How's Your Health*, 1930. Tarkington's popularity springs chiefly from his humor, his warm sympathy with people and his ingratiating style. He published *Wanton Mally*, a novel, in 1932.

TARO (*Colocasia esculenta*), called also dasheen, a coarse herb of the arum family, widely grown in the tropics for its large tubers which are an important article of food. It is believed to be native in the Pacific islands where it is extensively cultivated. The plant is valued also for the blanched shoots from the tubers, utilized as a winter vegetable, and for the young leaves used as a potherb. In Hawaii the starchy root, after being cooked, is fermented producing the food called poi. The Egyptian taro or culcas (*C. antiquorum*), native to the East Indies and cultivated since ancient times for food, is inferior in quality to the taro of the Pacific.

TARPON (*Tarpon atlanticus*), a large marine game and food fish allied to the herrings, found from Long Island to Brazil and especially abundant on



COURTESY AMER. MUS. OF NATL. HISTORY

ATLANTIC TARPON

the Gulf coast and in the West Indies. It has an elongate, compressed body, covered with very large, brilliant, silvery scales, and sometimes attains a length of 8 ft. and a weight of 300 lbs. The tarpon is exceedingly active, preying upon schools of small fishes, and, although its flesh is inferior, ranks second only to the tuna as a game fish. It takes the hook with great spirit and, because of its size and strength, is very difficult for the angler to capture. The handsome scales, sometimes 3 in. across, are manufactured into various novelties.

TARPON FISHING, a sport practiced along the Atlantic coast from Long Island to Brazil, but particularly popular off the coast of Florida. Tarpon range from 2 to 6 feet in length and weigh from 30

to 400 pounds. A tarpon weighing 383 pounds has been harpooned, but the heaviest on record taken with rod and line weighed a little over 200 pounds.

Since fishing grounds are usually some distance from shore, fishing for tarpon with rod and line is now generally done from small motor boats, which also lessens the danger of trying to land such a large, strong fish. Some sportsmen however prefer to fish from a rowboat with an experienced man to row it. Trolling is the accepted method of attracting the fish. A heavy 8-foot pole is required, its butt usually being fitted into a leather cup swung from a belt at the waist or fastened to the seat. From 200 to 250 yards of linen line are used, a 12- to 18-inch mullet or strip of other fish being threaded on the hook for bait. Once a tarpon strikes, the fisherman is in for a fight that may last several hours, for these fish fight to the death. If it were not for the fact that they help kill themselves by their terrific leaps, few would be landed.

See Dimock, *The Book of the Tarpon*, 1911.

TARRAGON (*Artemisia Dracunculus*), a smooth, bitter-aromatic perennial herb of the composite family, closely allied to the mugwort and sagebrush. It is a native of Europe cultivated for its leaves which are used in seasoning and flavoring as, for example, vinegar and pickles.

TARRAGONA, a city of Spain, capital of the province of Tarragona, located on the Francoli River where it flows into the Mediterranean. It is on the slope of a hill, the old part surrounded by walls, the newer part regularly laid out beneath. The city has a 12th century Gothic cathedral, and there are numerous Roman remains of the walls, amphitheater and the palace of Emperor Augustus. The chief industries are spinning, weaving and grain milling. Trade and shipping are of great importance. Called *Tarraco*, Tarragona was capital of this part of Spain in Roman times. Est. pop. 1929, 28,000.

TARRANT CITY, a city in Jefferson Co., northern Alabama, five mi. north of Birmingham, served by the Birmingham Electric Railway. Its post-office is a branch of Birmingham. The chief manufactures are cast iron pipes, coal and coke and Portland cement. Tarrant City was incorporated as a town in 1918, and as a city in 1927. Pop. 1920, 734; 1930, 7,341.

TARRYTOWN, a village in Westchester Co. in southeastern New York, situated on the east bank of the Hudson River, rising high above the water, 25 mi. north of Manhattan. The broadening of the river at this point is known as the Tappan Zee. Tarrytown is on the Albany Post road, built in 1723 and then called the King's Highway. Bus lines, river craft, ferries to Nyack and the New York Central Railroad serve the village. Tarrytown has several manufactures including automobiles and clothing. The Dutch founded the village in 1645, burning out the Indians who preceded them. Tarrytown was incorporated in 1870. There are many spots of interest nearby: Sunnyside, the home of Washington Irving and the old Dutch church and Sleepy Hollow

Cemetery where WASHINGTON IRVING, ROBERT G. INGERSOLL and CARL SCHURZ are buried. The region around Tarrytown was neutral territory between the lines of the opposing forces during the American Revolution. MAJOR ANDRÉ, the British spy, in league with Benedict Arnold, American soldier, was captured in this vicinity on Sept. 24, 1780. Pop. 1920, 5,807, 1930, 6,841.

TARSIER (*Tarsius philippensis*), a species of lemur, closely related to the AYE-AYE, called also malamag. This curious little creature inhabits lowland forests from Sumatra to the southern Philippines. It is about the size of a rat, has a large head with immense eyes; long, squirrel-like hind legs with long toes terminating in soft pads, and a very long, tufted tail. It easily climbs smooth bamboos, hides during the day in a hole in a tree or among its roots, and at night seeks its food, which consists of small lizards and various insects. It is regarded with superstitious veneration by the native peoples of its region.

TARSUS, a city of Turkey in Asia Minor, situated about 10 mi. from the sea on the banks of the River Cydnus and surrounded by a fertile plain. Tarsus, a very old city, was mentioned as Tarzi as early as the 9th century B.C., and Mark Antony, whom Cleopatra visited here in 38 B.C., made it a free city. About 660 Tarsus passed under Arab rule together with the whole of Cilicia. The city, important under Byzantine rule, passed in the 16th century into Turkish hands. Pop. 1927, 73,680.

TARTAR EMETIC, a common name for potassium antimonyl tartrate, $K(SbO)C_4H_4O_6 \cdot \frac{1}{2}H_2O$, a drug used as an emetic in medicine and as a mordant in dyeing. It is a crystalline substance with a nauseous metallic taste. It is prepared by heating antimony oxide with cream of tartar and water.

TARTARIC ACID, one of the most important and commonly occurring dibasic acids of the vegetable kingdom, formula $C_4H_6O_6$. It occurs in four stereo-isomeric forms: dextro-, levo-, meso-, and racemic tartaric acid. The dextro form is the most common, occurring principally as the potassium or calcium salt. Grapes contain large amounts of the acid potassium salt, which separates in the fermentation of wine as tartar and in purified state is cream of tartar. The dextro and levo modifications form clear monoclinic crystals, melting at $168^\circ C$., very soluble in water and alcohol. The free acid is used in baking powders and its salts are extensively used in pharmaceutical preparations. J. E. C.

TARTARUS, in classical mythology a place of punishment for those who displeased ZEUS. It was situated as far below Hades as earth was below heaven. Here the TITANS were imprisoned. In later legends it was a place of punishment for all, and was synonymous with HADES. When personified, Tartarus was son of Aether and Ge, and by Ge the father of the giants and Typhoeus.

TAR TESTING comprises the following more commonly used tests:

Bitumen Content. See ASPHALT TESTING.

Specific Viscosity. See ASPHALT TESTING.

Float Tests are made on tars not soft enough for the specific viscosity test. A small brass collar is filled with tar and cooled to $5^\circ C$, and then screwed into a saucer-like float. The float is placed in water, usually at $50^\circ C$, until the water breaks up through the tar. The float value is the number of seconds for the water to break through.

Softening Point. There are two methods of determining softening point. In the "ring-and-ball" test a small ring is filled with tar and cooled to either 5° or $30^\circ C$. The specimen is placed either in a water or glycerin bath with a $\frac{3}{8}$ -inch steel ball on top. The bath is heated at the rate of $5^\circ C$ per minute. The softening point of the material is taken as the temperature indicated when the ball has forced the tar one inch below the ring. In the "cube-in-water" test a $\frac{1}{2}$ -inch cube of tar is prepared, cooled, and placed on a wire hook in a water bath at either 15.5° or $4^\circ C$. The bath is heated at the rate of $5^\circ C$ per minute. The softening point is taken as the temperature shown by the thermometer when the cube has dropped one inch.

Distillation Test. A 100 gram sample is heated in a special distilling flask at a definite rate. The vapors given off are condensed and collected. As the temperature shown by the thermometer passes $110^\circ C$, $170^\circ C$, $235^\circ C$, $270^\circ C$, and $300^\circ C$, a different flask collects the distillate. Distillation values are the percentages that each distillate fraction is of the original weight of the sample.

Specific Gravity Tests. See ASPHALT TESTING. E. E. B.

TARTU (DORPAT), the capital of the district of the same name, in the republic of Estonia, situated in a hilly region on the navigable Emajõgi, with a stone and wooden bridge. New sections have grown up beyond the inner city and there are many churches and chapels. On the Cathedral, or Castle Hill, the nucleus of the city, are the impressive ruins of a cathedral, built in 1228, the medical school, clinics, observatory and library of the university, and fine parked promenades with monuments. The university, at the foot of the hill, was founded by GUSTAVUS ADOLPHUS in 1632 and was, until 1889, a German institution in close touch with the universities in Germany with famous German scholars as teachers. At present the university is Estonian, though foreign professors may lecture in German. There are other educational institutions, learned societies, a museum and botanical garden. Settled by Estonians 1030, it was conquered by the Germans in the 13th century and the bishopric founded. Later it became an important trade center and joined the Hanseatic League. Est. pop. 1931, 69,933.

TARTUFFE, the chief character in a play of that name by MOLIÈRE. He is an arch-hypocrite who, under an appearance of great piety, conceals his designs on the property and the wife of his benefactor, Orgon, only to be shown up at last for what he really is.

TARWEED, the name given to numerous viscid, heavy-scented annual and perennial herbs of the composite family. They are chiefly species of *Madia* and *Hemizonia*, about 40 in all, found in western America occurring most numerous in California. The



HAYFIELD TARWEED
(*Hemizonia congesta* var. *luzulaefolia*).
Achene, flowering branchlet and ray flower

Chile tarweed (*M. sativa*), with very sticky ill-scented herbage, abundant as a weed in the Pacific states and Chile and of limited use for forage, is sometimes cultivated for its oily seeds. The coast tarweed (*H. corymbosa*) and the showy tarweed (*M. elegans*), both with handsome yellow flowers, are widespread in California.

TASHKENT, the largest trade and industrial city of central Asia, in the northeastern part of the Uzbek S.S.R., of which it is now the capital, and at the southern termination of the Turksib Railway, opened in 1930 to provide for the exchange of the cotton of central Asia with Siberia's wheat. Branches of the Sur-Darya River make an oasis around Tashkent, which is divided into a bustling new town and an old section. A leading industry is fruit drying; cotton, tobacco, leather, cellulose, fruit and agricultural produce are exported. Originally the home of Tadjiks, Tashkent came under the control of Turkomans, Arabs and other tribes, and was taken by Russian forces in the year 1865. Here is the seat of the Central-Asiatic Communist University; numerous mosques and museums recall the city's great age. Pop. 1926, 323,544.

TASMANIA, an island state of the Commonwealth of Australia, situated in the South Pacific Ocean, near the southern extremity of the continent from which it is separated by Bass Strait, 140 mi. wide. Its area is 26,215 sq. mi.; in 1930 the population was reported as 215,976. Hobart, seat of the University of

Tasmania, is the capital, and other towns are Launceston, Devonport and Ulverstone.

The island is generally hilly, with numerous streams and expanses of open plains. The hot winds of Australia do not reach Tasmania, and the climate is salubrious. Apples and potatoes are the principal crops, but oats, hay and hops are also grown. Cheap hydroelectric power has attracted new manufacturing industries in recent years; there are metallurgical plants for the manufacture of copper and silver, and woolen, cement and fruit-preserving factories. Wood pulp is being produced from the waste of a 300,000 acre forest area. Forest reserves total 1,698,150 acres.

Its discoverer was Abel Jans Tasman, a Dutch navigator who first sighted the island Nov. 24, 1642 and named it Van Diemen's Land, after the governor-general of the Dutch East Indies. In 1803 it was first settled as an appendage of New South Wales, from which it was separated in 1825. "Tasmania" replaced the original name in 1853. Responsible government was granted the colony in 1856, and in 1901 Tasmania became a state.

TASMANIAN, division in anthropology. See RACES OF MANKIND; *Negroid Group*.

TASSEL FLOWER (*Emilia sagittata*), a smooth, slender annual of the composite family called also Flora's-paintbrush. It is probably native to the tropics of the New World and is now widespread in cultivation as a garden ornamental. The erect stem, 1 to 2 ft. high, bears oblong leaves with a broad arrow-shaped clasping base and numerous rayless scarlet flower-heads borne in loose clusters.

TASSO, TORQUATO (1544-95), Italian epic poet, was born at Sorrento, Mar. 11, 1544. He came of noble family, his father, Bernardo Tasso, was a poet of considerable distinction. He attended Jesuit schools in Naples, and after the family fortune was confiscated and his father exiled to Rome, he joined the latter to continue his studies. His genius was first shown in *Rinaldo*, an epic produced at the age of 17; but he continued his philosophical and literary studies until 20, when he began leading the life of a courtier. Under the Duke of Ferrara, Alfonso II, he started work on the celebrated *Gerusalemme Liberata*, on which he spent 10 years. He had meanwhile written *Aminta*, a pastoral drama famous in literature. *JERUSALEM DELIVERED* is an epical masterpiece centering around Geoffrey, the leader of the expedition to Jerusalem, and relating how the latter overcomes the seductions of the enchantress Aminda and finally wins Jerusalem. Tasso's great glory rests on this vast epic, adequately compared only to such other mighty works as the *AENEID* or *PARADISE LOST*. Its profound and permeating influence on both Italian and European literature has frequently been acknowledged.

The latter end of Tasso's life is a tale as sad as any in his epic. Although befriended by the sisters of the Duke, Lucrezia and Eleanora d'Este, with the latter of whom he is said to have been secretly in love, he was imprisoned from 1579-86 on the charge of in-

sanity. Even during this period of gloom the poet's genius could not rest, but poured out a constant stream of powerful writings, as if to prove to the world the unjustness of his imprisonment. Among the works thus produced are *Letters*, *Classical Dialogues*, *Moral Discourses* and nearly 1,000 *Sonnets*. His published works number more than 30 volumes. Tasso was finally released, and wandered to Rome. There, by a turn of fate, Pope Clement VIII was just preparing to present to him the supreme reward of poets, the laurel crown, when Tasso died at the Convent of St. Onofrio, Rome, Apr. 25, 1595. *See also* EPIC; ITALIAN LITERATURE.

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TASTE, ORGAN OF. Sensations of taste are registered in minute taste buds in the tongue and carried by certain nerves to the brain. The taste buds are in ovoid depressions in the epithelium covering the tongue. The contents of these minute cavities consist of a number of fusiform cells arranged like the staves in a barrel, together with some cells of similar shape in which the nerve fibers terminate.

Though they can be found in any part of the tongue, taste buds are especially common in a V-shaped region behind the tongue. Certain parts of the tongue are associated with certain kinds of taste. For example, sweet tastes are perceived near the tip of the tongue, and bitter tastes near the back of the tongue. The sense of smell plays a greater part than is generally realized in tasting objects in the mouth. This is attested by the blunting of taste that accompanies a cold. *See also* MOUTH, DISEASES OF; TONGUE.

TATE GALLERY, officially the National Gallery, Millbank, an art museum located on Grosvenor Road, London, presented to the nation in 1892 by Sir Henry Tate (1819-99). The collection, housed in a building of free classical design, contains 200 paintings of the early British school, drawings and canvasses by Turner and Sargent, and classical and modern works by foreign artists.

TATLER, THE, a London paper published thrice a week by RICHARD STEELE, between Apr. 12, 1709 and Jan. 2, 1711, comprising 271 numbers of which 41 were written by JOSEPH ADDISON. The forerunner of the famous SPECTATOR, the paper at first narrated merely the news of the day but, with the advent of Addison, became more and more an organ for the expression of social and semi-political ideas. An illustrated London weekly founded in 1891 and dealing with society, sport and the stage, has also been called *The Tatler*.

TATPOOS, an extinct North American Indian tribe. They spoke the Comox dialect of the Salishan linguistic stock, and formerly occupied the eastern section of the larger Valdes Island and the east coast of Vancouver Island, Brit. Col.

TATTOOING, the practice of decorating the human body by injecting coloring matter into in-

cisions or punctures in the skin. Among primitive peoples tattooing is almost universal. Its origin is disputed but in all probability the first savage to so decorate his body thought to enhance his attraction for the opposite sex. In general, tattooing is ceremonial or symbolic and signifies membership in a certain tribe, or bravery, the attainment of puberty, mourning or other condition or circumstance.

The Maori of New Zealand and also the Polynesian natives of the Marquesas Islands in the South Seas excel in this art. Their men are tattooed from the crown of the head to the toes. With them the process starts at about the age of 12 and is completed when the subject is about 30. The Jinriksha-men of Japan and other Japanese who work half naked are frequently elaborately tattooed. The Arabs, Eskimo and the Indians of North and South America also practise tattooing in simple forms. Tattooing is a well-known eccentricity of sailors and soldiers of modern civilized nations.

TAUCHNITZ, KARL CHRISTOPH TRAU-GOTT (1761-1836), German publisher and printer, born at Grossbardau, Saxony, Oct. 29, 1761. In 1796 he opened a printing business in Leipzig. He introduced printing from stereotyped plates into Germany and produced stereotyped editions of the Bible, of Greek and Latin classics and of dictionaries which were both inexpensive and accurate. After his death, Jan. 14, 1836, in Leipzig, his son, Karl Christian Phillipp (1798-1884), took over the firm. The more famous Tauchnitz publishing house was established by Christian Bernhard, later made a baron, the nephew of Karl Christoph, in 1837.

TAUGHANNOCK FALLS, a cataract occurring on Taughannock Creek which enters Cayuga Lake a few miles north of Ithaca, N.Y. The creek runs through a postglacial gorge 1¼ mi. long, with a depth of 350 ft. The water in descending from the plateau to the lake forms several cascades, principally Taughannock Falls which descend 210 ft. in an unbroken sheet over a limestone terrace. These falls have receded about 1 mi. from the lake shore. They are the highest in New York State being 48 ft. higher than Niagara and are of the same type in that while receding they maintain their height and do not turn into rapids. Taughannock Falls and Cayuga Lake are in the Finger Lakes region of New York where rocks and valleys have revealed important geological history.

TAUNTON, the county town of Somersetshire, England, on the Tone, in the valley of Taunton Dene, a rich agricultural district famed for apples and cider, 163 mi. southwest of London. Of Roman-British origin, it attained some importance in Saxon times. Of the 12th century castle, dismantled at the Restoration, enough remains to house a museum. Norman and Early English features are distinguishable in the Perpendicular parish church, and among other antiquities are a notable market cross and the scant remains of a priory founded in Henry I's reign. In modern Taunton, silk manufacture introduced in the

late 18th century persists, together with other fabric weavings, brewing, and a Saturday market dating from before the Conquest. Pop. 1921, 24,195; 1931, 25,177.

TAUNTON, a city in southeastern Massachusetts, and a county seat of Bristol Co., situated on the Taunton River at the head of ocean navigation, about 36 mi. south of Boston. It is served by bus lines and the New Haven Railroad. There is an airport. Taunton has extensive shipping interests and varied manufactures. In 1929 the factory output was approximately \$32,000,000; the retail trade amounted to \$16,799,765. Located here are a State Hospital for the Insane and Morton Hospital. About 1638 settlers from the Massachusetts Bay Colony founded Taunton near the site of an Indian village called Tecticut. They named the settlement Cohannet, but later the name was changed in honor of Taunton, England. When the Boston Port Act was passed in 1774, the people of Taunton, led by Robert Treat Paine, showed their sympathy by raising a red flag on the village green, inscribed "Liberty and Union." In 1865 Taunton was incorporated as a city. Pop. 1920, 37,137; 1930, 37,355.

TAURUS (gen. *Tauri*), the bull, the second constellation of the Zodiac containing a wealth of bright stars and interesting objects. It is visible from August until April and may be seen high in the southern sky during early winter evenings. The brightest star, **ALDEBARAN**, is orange in color and of the first magnitude. It forms part of a V-shaped group of stars called the **HYADES** or rain stars, because their first appearance each year ushered in the rainy season in Greece. Slightly to the northwest are the **PLEIADES**, or Seven Sisters, a small cluster of stars in which the naked eye can count from six to ten and the telescope reveals thousands. The designations of Aldebaran, the Hyades, the Pleiades and of the whole constellation Taurus are among the very oldest known. The word Pleiades occurs in the book of Job, and Aldebaran is referred to by the Chinese, as early as 2500 B.C. as the "star of spring." See **STAR: map**.

TAUSSIG, FRANK WILLIAM (1859-), American political economist, was born at St. Louis, Mo., Dec. 28, 1859. He became instructor of political economy at Harvard in 1882 and professor in 1892. He was president of the American Economic Association in 1904-05 and chairman of the United States Tariff Commission, 1917-18. He received the honorary degree of doctor of philosophy from the University of Bonn in 1928. Among his chief writings are *Tariff History of the United States*, 1888, *Wages and Capital*, 1896, *Principles of Economics*, 1911, *Free Trade, the Tariff and Reciprocity*, 1919, and *International Trade*, 1927.

TAUTOG (*Tautoga onitis*), a spiny-rayed, marine food fish of the WRASSE family (*Labridae*) found along the Atlantic coast from New Brunswick to South Carolina. It averages about a foot in length, though specimens 3 ft. long have been recorded, and has an oblong, blackish body, a large head, thick lips, and

strong teeth adapted to crushing shells. The tautog is a bottom fish, usually frequenting rocky shores, and feeding largely upon mollusks and crustaceans. Its white, flaky, fine-flavored flesh finds a ready sale in the markets. In 1929 the catch in United States waters, taken chiefly by means of hand lines, was 649,000 lbs., valued at \$45,000.

TAWAKONI, a tribe of North American Indians belonging to the Wichita group of the CADDOAN linguistic stock. They were a member of the Wichita Confederacy and during the 18th and 19th centuries lived on the middle Brazos and Trinity rivers in Texas. They were placed on a reservation in 1855 near Ft. Belknap but in 1859 were forced to move by the whites. Since then they were incorporated with the Wichita with whom they subsequently shared a reservation in Kansas.

TAXATION, the provision of public revenue through compulsory contributions from the wealth of persons or bodies of persons. In this modern conception of taxation the following characteristics are emphasized: first, the element of public purpose; second, the element of compulsion; and third, the source of tax revenue, which is the wealth of the citizens.

Since taxes constitute by far the most important source of revenue for the modern state, the first and most essential requirement of the taxation system is that it be productive. The state must have revenue to carry on its essential purposes and functions. Assuming that this practical requirement is met, careful attention should be given to the manner in which the tax burden is distributed among all of the taxpayers. Tax levies being compulsory, the citizen's main defense against unjust taxation is in the character of the tax system itself.

The distribution of all governmental costs must be considered in connection with the ends or purposes of government. Some governmental services are for the general good, and their results, while socially advantageous, are intangible. Other services are capable of precise measurement in terms of cost or benefit. The character of the charge or levy made upon the citizen corresponds to this scale of the character of the services. At one end, the service may be purely commercial, such as the supply of electric current or the transfer of funds by postal order. As long as the real nature of such services is recognized, the charges will be adjusted as they would be by private producers, that is, according to the cost of the service, and such charges would be called prices.

Next in the scale would come specific, measurable services to the individual such as the recording of property titles, the examination of banks, the issue of marriage licenses and so on. The charges made for these and similar services in which there are elements of both public and private advantage, are known as fees.

Finally, there is the broad range of governmental services in which the element of individual benefit may be small or lacking, while the general social advantage bulks large. Taxation is used, for the most

part, to provide the revenue to cover the cost of these services.

The dividing lines between these classes of services is not always sharp and clear. Both prices and fees may therefore be adjusted to yield more or less than the exact cost of the services given. Likewise, some manifestations of the taxing power are for purposes in which there is a distinct element of individual benefit, as in the construction of sewers, sidewalks and pavements. The levy upon the property benefited by such improvements is called a special assessment, which is akin to a tax in being compulsory and for a public purpose, but which differs from a tax in being a charge to defray the cost of a specific local improvement, rather than for the general purposes of government.

The following matters of terminology are important. First, taxes may be direct or indirect. While these terms have been used in different meanings, the accepted usage today is that employed by J. S. Mill who defined a direct tax as one which is borne by the person paying it, and an indirect tax as one which is paid by one person and passed along or shifted to another. Second, tax rates may be proportional, progressive or regressive. A proportional tax rate is one which is the same for any amount of the tax base. A progressive tax rate increases as the tax base becomes greater. A regressive tax rate becomes less as the tax base increases. This kind of rate is never used today by design, although some forms of taxation, such as the property tax, may actually be regressive in effect, as a result of the undervaluation of more valuable properties. A tax rate structure may also be degressive, which means the exemption of a limited amount from all tax, and the further exemption of diminishing amounts up to a certain level, beyond which the full rate is applied. The British income tax illustrates this form.

Other terms which are not always understood or used correctly are the source, the subject and the object of taxation. The source of taxation is normally the income of the people, unless the tax burden should become so heavy, either in the aggregate or in individual cases, as to absorb a part of the capital. All taxes are paid from income in the form of RENT, WAGES, INTEREST or from CAPITAL. The subject of taxation is the individual who pays the tax, that is, who is subject to taxation. The object of taxation is the thing taxed. The courts have often been conspicuously ignorant of the distinction between the source and the object of taxation, a fact which has grievously marred the reasoning of many decisions.

The proper and equitable distribution of the tax burden involves at least the following issues: first, the relation of taxpayers to the state; second, the relations among classes of taxpayers; third, the relations of different sources of income or taxable ability; fourth, the relations of different taxing jurisdictions; and fifth, the relations of different public aims or purposes.

The relation of taxpayers to the state raises the

question of the basis on which shall each contribute. Two doctrines have appeared, one holding that taxation should be according to benefits, the other that taxation should be according to ability. As a matter of practical construction of tax systems, each of these principles deserves consideration, and each will probably govern the effect of certain parts of the entire system. The property tax at proportional rates illustrates the application, primarily, of the benefit principle, while the personal income tax at progressive rates illustrates, primarily, the ability principle. Neither of these principles is capable of complete application throughout the entire tax system, and the working result is a blend of the two.

The second issue, namely, the relations among classes of taxpayers, involves the manner in which tax rates shall be applied. This is the question of proportional versus progressive rates, around which there has been such debate since the days of ADAM SMITH. It is clear that every tax rate could not be progressive without producing most incongruous and inequitable results, although any given form of taxation could be levied at a proportional rate. The use of progressive rates is associated with the question of ability, and in those cases in which there is opportunity to measure the entire taxable ability of a group of taxpayers, the progressive principle is justified, since there is general agreement that ability to pay rises at a faster rate than the tax base, whether this is income or property. An income tax levied against each individual's entire income or an estate tax levied against each estate as an entity, may therefore safely be progressive. If there were but one taxing jurisdiction levying property taxes, and if each person's property were lumped together, progressive property taxation would be acceptable. Under the existing system of property taxation in the United States, the use of progression would be highly inequitable, since each little jurisdiction taxes only that property within its limits. Customs and excise taxes cannot be levied at progressive rates, since the tax is paid at each purchase, and on the amount of that purchase. The comprehensive tax system must therefore make use of both proportional and progressive taxation.

The third issue, which is the relation of different sources of taxable ability, involves the distinction between incomes from property and from personal services. In the Federal income tax it is the distinction between so-called unearned and earned incomes. This distinction would also be more appropriate if there were but one taxing authority levying all taxes. Since the state and local revenues are derived very largely from property taxes, there is good reason to believe that the combined effect of these taxes and of the Federal income tax constitutes a decided tax discrimination against property or unearned incomes, without further emphasis such as is given in the Federal law. The discrimination was introduced without any attempt to discover the facts on this point, and it may therefore be regarded as having a political rather than a social basis.

The fourth issue, the relations of different jurisdictions, is the problem of double taxation. This arises when two or more coordinate jurisdictions, as two states or the Federal government and a foreign nation, tax the same object. The problem of tax allegiance is complicated, and an individual may owe taxes in two states; but he should not be taxed in both states on all of his property or all of his income. The solution of double taxation requires general acceptance of uniform rules to determine the tax liability, or a system of reciprocity, which is one method of establishing a definite tax allegiance for each taxpayer.

The final issue involves the use of taxing power for purposes other than that of providing public revenue. Such a policy would be contrary to the definition of taxation given above. Support will be found for the proposition that the state should use this power to achieve other desired ends, such as an equalization of the distribution of wealth, the restriction or suppression of a business, the removal of billboards from the countryside, the regulation of child labor, and so on. In view of the volume of revenue now required for necessary public expenditures, and in view also of the problems involved in designing an equitable revenue system which will achieve this primary end, the wise position appears to be that the taxing power should be confined to this fundamental purpose. Any tax has, naturally, certain indirect and ultimate effects on the individual or his business. There is ordinarily no difficulty, however, in distinguishing between a tax system which is designed to fall equitably upon all persons and all forms of enterprise, for the purpose of providing revenue, and one which is filled with discriminatory measures intended for regulation or suppression rather than for revenue. If social control is considered necessary, it should be provided for directly rather than through a destructive use of the taxing power. It was an abuse of the taxing power rather than its proper use for providing public revenue to which Chief Justice JOHN MARSHALL referred in his famous, but often misunderstood dictum, "The power to tax is the power to destroy." See also INCOME TAX; INHERITANCE TAX; PROPERTY TAX; SALES TAX; STAMP TAXES; SHIFTING OF TAXES. H. L. L.

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TAXICAB, an individual mechanically-powered passenger vehicle with a seating capacity of seven or less, which, with a driver, may be hired by any person as a common carrier but which must devote itself exclusively to the service of the rentor and not hold itself open for hire to any other person until the prior engagement is completed. It does not operate on a fixed route or schedule, or between fixed termini, but is free to operate over any route or between any points and within any time that the rentor decides. Either a flat rate for any length of ride or for certain zones is charged or the taxicab is equipped with a taximeter, an instrument which registers the fare mechanically.

Taxicabs, along with sightseeing cars and automobiles for hire, are termed public hacks. At the first of 1932 there were 140,000 taxicabs in the United States, 84,000 of which were operated by responsible, organized companies. C. A. F.

TAXIDERMY. Strictly speaking, the preservation of the skins of animals, birds, fish or reptiles, covered with fur, feathers or scales, and the mounting of the specimen to give a lifelike appearance. The art seems to have been practiced for some 300 years. In the latter part of the 18th century, many amateurs became interested in taxidermy, and mounted birds and fishes were displayed in many American homes. To-day, taxidermy is left almost entirely to professionals. To preserve the skin properly, it must be removed with the greatest care, as in small specimens especially, any stretching of the wet skin shows in the finished result. Once removed, the inside is painted with a preservative paste or powder, arsenic, alum, saltpeter, chloride of lime and mercury bichloride being among the chemicals used. The skull and the leg and wing bones of birds are cleaned and returned to their proper place; a rough body is shaped of chopped tow or other stuffing, placed inside the skin, and built up until it assumes the proper shape, wires being attached to the leg and wing bones. Animals are treated in much the same way, the skull being cleaned and returned and a rough body modeled over stiff wires. This is placed within the skin and built up to proper shape, the wires being bent to give the desired pose.

During the last few years, great advances have been made in the artistic modeling and arranging of specimens. To-day the professional first models a body of clay or plaster over a framework of wood and wire mesh. When this is perfect in every detail of desired position, the skin is fitted over it.

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TAXONOMY, the science of classification, especially the classification of plants and animals. Since prehistoric times animals have been grouped according to external structure and appearance. Insects, fishes, birds, reptiles, and beasts (quadrupeds) are groups representing a classification as old as recorded history. Plants were at the same time divided into trees, shrubs, and herbs, and certain groups, such as the mosses, ferns, and palms, have received recognition since the beginning of history.

An early attempt at a classification of animals was made by Linnæus (*Systema Naturæ*, 1735), who divided the animal kingdom into six groups, Quadrupedia, Aves, Amphibia, Pisces, Insecta, Vermes. Cuvier (1817) proposed a system upon which, though greatly modified, the generally accepted modern classification is based.

In botany the sexual system of classification, introduced by Linnæus in his *Systema Naturæ* and generally known as the Linnæan classification, was a great step in advance. Linnæus based his classification mainly on the number and arrangement of the

stamens and pistils. This system was a great convenience in the identification of flowering plants but was admittedly an artificial system since it often brought into the same groups plants that were evidently unrelated. Linnæus himself recognized that his system was only a temporary expedient until botanists should have time to work out a natural system. The convenience of the sexual system brought it into use at once and gave systematic botany a great impetus.

Even while using the sexual system, attempts were made to work out a natural system which should classify plants according to their relationships. The first important natural classification was proposed by A. L. de Jussieu in 1789. Several natural systems have since then been proposed, the latest being that of Engler and Pratl, which is now generally adopted.

Modern classification of living things is based upon genetic relationships. According to the theory of organic evolution all living things are related to each other through interwoven lines of descent. Since the genetic relationships are not known absolutely but are inferred by comparisons of structure, taxonomy represents, at any given time, a summation of our knowledge up to that point.

The unit of classification is the species, which includes all the individuals that resemble one another, and would be called in common language a single kind or sort of plant or animal. Zoologists include all the living races of men in a single species. Botanists include all the races and varieties of corn (maize) in a single species. These examples will illustrate the meaning of the term species.

The species are grouped into genera, the genera into families, the families into orders, the orders into classes, and the classes into phyla. For example, among animals the lion (*Felis Leo*) is a species; the lion, tiger, leopard, domestic cat, and several other kinds of cats form the cat genus (*Felis*); the cat genus, the lynx genus, and the cheetah genus form the cat family (*Felidae*); the cats, dogs, bears, seals, and other families, constitute the order of Carnivora or carnivorous animals (*Carnivora*); the carnivores; ungulates (hoofed mammals), and other orders form the class of mammals (*Mammalia*); the mammals, birds, fishes, reptiles and other classes, form the phylum of vertebrates (*Chordata* or essentially *Vertebrata*); the great phyla, vertebrates, mollusks, arthropods (such as insects, crustaceans and others), and several others make up the Animal Kingdom. Among plants, the white oak is a species (*Quercus alba*); the species of oaks, the white oak, black oak, red oak, and many others form the genus of oaks (*Quercus*); the oaks, chestnuts, and beeches form the beech family (*Fagaceae*); the beech family and birch family form the beech order (*Fagales*); the numerous orders of plants with two seed leaves to the embryo form the class of dicotyledons (*Dicotyledoneae*); the classes of dicotyledons, monocotyledons (lilies, grasses, and the like), and gymnosperms (pines, spruces, and cedars) form the phylum of seed plants (*Spermatophyta*); the phyla

of seed plants, ferns, mosses, thallus plants, and bacteria make up the Vegetable Kingdom.

For convenience there are other groups, subdivisions of those mentioned when they are needed. Any of the chief groups when large, may have subgroups, such as suborder, subfamily, and subgenus. Genera are often grouped into tribes and subtribes under the family. Zoologists sometimes group genera to form super genera, a term not common in botany. It is convenient often to recognize subdivisions of the species when the individuals show considerable variation. In zoology the subdivisions of the species are usually called subspecies. In botany these subdivisions are usually called varieties, but there is a tendency among botanists to use the term subspecies for wild plants, reserving the term variety for cultivated plants. A species extending over a wide area often presents minor variations corresponding to geographical areas. Such variations are sometimes called geographical races. Race is often used in botany to indicate groups of varieties among cultivated plants. Some botanists recognize minor variations within a species as variety, subvariety, and form.

The characters used in classification are those which by common consent are considered the most dependable in showing relationships. The groups in a classification are seldom based on a single character but on a summation of characters. Herbert Spencer stated that organisms are classified according to the totality of their morphological resemblances.

The characters assigned to the phyla are the most fundamental and represent differences that were developed very early in the phylogenetic history of living organisms. The characters of the classes are somewhat less fundamental but the difference appeared very early in life upon earth. Fossil remains show that differences separating orders and even families had already appeared in early eras. More recent fossils show differences of genera comparable to those that appear in living organisms. Some fossil species appear to be the same as those living upon the earth to-day. Furthermore, species appear to be in a state of gradual change. Certain species of wide range and vigorous development are probably gradually breaking up into diverse species. In consequence of the gradual changes and the variations taking place among the individuals of a species, the characters separating species cannot always be given with definiteness. It is therefore inevitable that all systems of classification must be subjected to revision as additional knowledge accumulates; and that the difference between groups should be indefinite at certain points.

No matter how clean-cut and satisfactory a key or synopsis indicating differences may be there are intermediate organisms that tend to unite groups or render the boundary lines of the groups indistinct. The evolutionary phylogenetic development of organisms has been and continues to be dynamic, ever-changing; systems of classification to be usable must be static. It follows that no system of classification can be exactly superimposed upon Nature.

A. S. H.

TAX RATE. In England the "rate" refers to local taxes. In the United States the "rate" is the amount of tax that falls on each unit of the base of any tax, or on each dollar of valuation.

TAX TITLE, a title derived from a tax sale. When there is a default in the payment of taxes for a period of time varying in different localities, the property is put up at public auction. The purchaser who may be the original owner acquires the title. Substantial compliance with the requirements of the law must be observed. Thereupon the title is good against all claims, except in Pennsylvania, where, under certain conditions, liens are not voided.

TAYLOR, BAYARD (1825-78), American writer and diplomat, was born at Kennett Square, Pa., Jan. 11, 1825. When 20 he took a pedestrian tour abroad, and after his return worked for the *New York Tribune*, for which he wrote the rest of his life. *Views Afoot* tells of these first travels, and *Eldorado* relates his experiences with the *Forty-niners* in California. In 1862 Taylor became secretary to the American legation in St. Petersburg, and in 1878 was appointed Ambassador to Germany. He wrote voluminously throughout his career. An excellent translation of Goethe's *FAUST* is perhaps his chief literary product. Among other publications are *Travels in Greece*, *Hannah Thurston* and *Poems of the Orient*. *The Bedouin Song* is his best known poem. Taylor died in Germany, Dec. 19, 1878.

TAYLOR, BERT LESTON (1866-1921), American author, was born in Goshen, Mass., Nov. 13, 1866, and educated at the College of the City of New York. He became nationally famous for his column in the *Chicago Daily Tribune* headed *A Line O' Type* and signed "B.L.T." The column was widely syndicated and frequently imitated. Taylor's books include *The Well in the Wood*, *The Charlatans* and *Motley Measures*. He died in Glencoe, Ill., Mar. 19, 1921.

TAYLOR, DEEMS (JOSEPH) (1885-), American composer and writer, was born at New York City, Dec. 22, 1885. He was educated at the Ethical Culture School and New York University, and studied music under Oscar Coon during 1908-11. Among his compositions are the cantatas, *The Siren Song*, *The Chambered Nautilus*, and *The Highwayman*, the orchestral suite, *Through the Looking-Glass*, a pantomime, *A Kiss in Xanadu*, a symphonic poem, *Jurgen*, composed in 1925, and a suite for jazz orchestra, *Circus Day*. His outstanding works are undoubtedly the music for the two operas, *The King's Henchman*, produced by the Metropolitan Opera, New York, in 1927, and *Peter Ibbetson*, first produced by the Metropolitan on Feb. 7, 1931.

TAYLOR, GRAHAM (1851-), American sociologist, was born in Schenectady, N.Y., May 2, 1851. In 1873 he was ordained by the Dutch Reformed Church and held pastorates at Hopewell, N.Y., and Hartford, Conn., until 1892 when he became professor of social economics at Chicago Theological Seminary. Two years later he founded and became resident warden of the Chicago Commons Social

Settlement. He was president of the Chicago School of Civics and Philanthropy in 1903-20, and an associate editor of *The Survey*. He published numerous works on sociology including *Religion in Social Action*, 1913, and *Pioneering on Social Frontiers*, 1930.

TAYLOR, HENRY OSBORN (1856-), American author, was born in New York City, Dec. 5, 1856. He graduated at Harvard in 1878, and at Columbia Law School in 1881. He adopted writing as a profession and also became a popular lecturer. His *Treatise on Law of Private Corporations* has gone into several editions, but Taylor is better known for his various other works, including *Ancient Ideals*, *The Classical Heritage of the Middle Ages*, *The Medieval Mind*, *Prophets, Poets and Philosophy of the Ancient World* and *Human Values and Verities*, 1928.

TAYLOR, JEREMY (1613-67), English clergyman and author, born at Cambridge Aug. 15, 1613. Educated at Caius College, Cambridge, he was elected Fellow in 1633. Five years later he became rector of Uppingham in Rutlandshire, and during the civil wars, his royalist sympathies brought him the appointment of chaplain to Charles I. When political changes deprived him of his livelihood in 1642, he retired to write and teach, but after the Restoration, was appointed Bishop of Down and Connor in Ireland and was made a member of the Irish Privy Council. His chief works include *Liberty of Prophesying* (1647), *Holy Living* (1650) and *Holy Dying* (1651). The latter two are still widely read and esteemed among Christians of all churches. All his writings glow with a wealth of imagery and power, which have made him one of the classical writers of English. Taylor died at Lisburn, Ireland, Aug. 13, 1667.

TAYLOR, JOHN (1580-1653), English writer known as "the Water Poet," was born in Gloucestershire in 1580. As a youth he learned the trade of a waterman, and saw naval service abroad. Returning to England, he again became a waterman on the Thames River, and at one time was collector of wine duties. Taylor began writing verses which attracted considerable attention, and which are now valued chiefly for their pictures of the period. He opened a tavern at Oxford at the outbreak of the Civil War, and later kept a public house in London. He died at London in Dec. 1653. For his works see Hindley's *Works of John Taylor*, 1872.

TAYLOR, RACHEL ANNAND (1876-), Scottish poet and critic, was born in 1876. She was educated at Aberdeen University. The striking individuality of her poems, their emotional appeal, and fine craftsmanship have won wide recognition. Mrs. Taylor is a critic of authority, noted especially for her Renaissance studies. Among her volumes of verse are *Poems*, 1904, *Rose and Vine*, *House of Fiammetta* and *End of Fiammetta*, 1923. Other publications are *Aspects of the Italian Renaissance*, 1923, *Leonardo the Florentine*, 1927, and *Aspects of the French Renaissance*, 1928.

TAYLOR, ROBERT BRUCE (1869-), Canadian educator, was born in Cardross, Dumbartonshire,

Scotland, Oct. 22, 1869. He studied at the universities of Glasgow, Marburg and Göttingen. After a period of lecturing in economics at Glasgow and Aberdeen universities, he entered the Presbyterian ministry and held pastorates in Ayrshire, 1896-99; Aberdeen, 1899-1906; London, 1906-11, and Montreal, 1911-17. In 1917 Taylor became principal of Queens University, Kingston, Ont., and served as such until 1929. He is the author of *Ancient Hebrew Literature*, 4 vols.

TAYLOR, TOM (1817-80), English playwright and journalist, whose full name was Thomas Proclus Taylor, was born at Bishop Wearmouth in 1817. He became editor of *Punch* in 1874 and wrote more than 100 plays, of which the most popular were *The Overland Route*, 1860, *The Ticket of Leave Man*, *Still Waters Run Deep*, *Twixt Axe and Crown*, *Lady Clancarty*, and *Masks and Faces*, with Charles Reade. Taylor was Professor of English Literature at London University, 1845, lawyer, journalist, and artist and art critic for the *London Times*. He died at Wandsworth, London, July 12, 1880.

TAYLOR, ZACHARY (1784-1850), 12th President of the United States, was born in Orange Co., Va., Sept. 24, 1784. He was the son of Col. Richard Taylor, who served in the Revolutionary War, and Sarah Strother Taylor, both of English descent. In the year of his son's birth, Col. Taylor moved to Kentucky, where he was appointed by Washington Collector of Customs at the port of Louisville. The Kentucky district was at this time menaced by Spanish intrigue and marauding Indians, and the future President was reared amid the dangers of frontier life. He gained an elementary education from Elisha Ayres, a New England tutor. The youth worked on a plantation until he was 24, when he was given the lieutenantancy made vacant by a brother's death.

Taylor was later commissioned captain, and in the War of 1812 he distinguished himself by defeating an Indian raid led by Tecumseh on Ft. Harrison, Ind., which he held with 50 fever-stricken soldiers. For this action Taylor was breveted major. He resigned in 1814 when the close of hostilities reduced his commission to captain, but his military talent was not long unemployed. President Madison, a distant relative, in 1816 offered him a commission as major, and Taylor accepted, beginning a 20-year period of military life. In the frequent Indian hostilities he gained increasing repute as a match for Indian courage and cunning. He was promoted to a lieutenant-colonelcy in 1819, and until the outbreak of the Seminole War in 1837, he served at various frontier posts. He negotiated the surrender of Black Hawk in the Indian War of 1832, and five years later, during the Seminole warfare, he commanded a force in the Everglades. Taylor's outstanding qualities as an Indian fighter were prominently displayed by his retaliatory measures against the guerrilla tactics of the Indians. On Dec. 25, 1837, he won the battle of Okeechobee, for which feat he was breveted brigadier-general. In 1840 he

was given command of the First Department of the army, and was stationed at Ft. Jessup, La. He purchased a plantation at Baton Rouge, and at 56 anticipated a quiet retirement. But he was on the brink of the most active period of his life. Taylor received orders in May, 1845, to prepare the Army of the Southwest for the defense of Texas. In July, when Texas was annexed, the general was ordered to occupy Texas and approach the Rio Grande, the newly claimed Mexican border. Taylor established headquarters at Corpus Christi, and patiently waited for signs of Mexican invasion. In March, 1846, after receiving conflicting orders from Washington, the army advanced to the Rio Grande, and in April the long-awaited "overt act" occurred when the Mexicans ambushed an American party. War was promptly declared on Apr. 24, and Taylor's first move was to force the Mexicans across the river. In quick succession he captured Matamoras, Monterey, and with only 5,000 troops defeated Santa-Anna's army of 20,000 at Buena Vista. The achievements of Taylor, a Whig, were an embarrassment to the Democratic administration which in the absence of any prominent Democratic general sought to deflect public attention from him by sending Gen. Winfield Scott, another Whig, to capture Vera Cruz. But "Rough and Ready" Taylor was widely acclaimed, and a presidential boom was launched for him in 1848 by Thurlow Weed of New York. The general accepted the Whig nomination and defeating Clay and Webster, was elected. He began his term on Mar. 5, 1849.

Taylor was scrupulous, honest, courageous, a man of common sense and simplicity. His death from typhoid fever at the White House, July 9, 1850, occurred before he had an opportunity of showing his fitness for the presidency. His lifetime having been passed as a soldier, nothing in his record indicated qualification for an office which popular acclaim of his martial triumphs had thrust upon him. He became President at a time of seething unrest in the country, and although a southerner and a slaveholder he announced that the people of the north "need have no apprehension of the further extension of slavery" and that any overt acts by the South would be met with force. He did not, however, favor the Wilmot Proviso, his own plan being the immediate admission of California as a Free State and the organization of New Mexico and Deseret (Utah) into Territories, in which the inhabitants were to decide for or against slavery. He died before the submission to him of the acts composing the Compromise of 1850.

Taylor was an Episcopalian. In 1810 he married Margaret Smith. There were four children, one son and three daughters. Richard Taylor (1826-79) was a lieutenant-general in the Confederate Army. A daughter, Sarah Knox Taylor, married Jefferson Davis in 1835. Taylor is buried near Louisville, Ky.

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TAYLOR, a mining borough in Lackawanna Co., northeastern Pennsylvania, situated on the Lacka-

wanna River, 3 mi. southwest of Scranton. It is served by several railroads. Anthracite coal mining is the leading industry. The retail business in 1929 amounted to \$1,587,549. Taylor was founded in 1790 and incorporated in 1893. Pop. 1920, 9,876; 1930, 10,428.

TAYLOR, a city in Williamson Co. in eastern Texas, situated 35 mi. northeast of Austin. Bus lines and two railroads serve the city. Cotton, corn, livestock and poultry are raised in the region. Packing plants, ore refineries, bedding factories and cottonseed mills comprise the chief industries. The city was founded in 1876. Dan Moody, governor of Texas from 1927-31, was born in Taylor. Pop. 1920, 5,965; 1930, 7,463.

TAYLORVILLE, a city in central Illinois, the county seat of Christian Co., situated 85 mi. northeast of St. Louis. It is served by bus lines and three railroads. There is an airport. Four large coal mines are located nearby. The region produces large crops of grain. A tool factory and a paper mill make up the chief industries. A stone slab commemorates the services of Abraham Lincoln in the Taylorville courthouse. Taylorville was founded in 1839 and incorporated in 1882. Pop. 1920, 5,806; 1930, 7,316.

TCHAD, LAKE. See CHAD.

TCHAIKOWSKY, PETER. See TSCHAIKOWSKY.

TEA (*Thea sinensis*), an evergreen shrub or small tree of the tea family native to southeastern Asia. Since remotely ancient times it has been grown as a beverage plant, the young leaves when properly gathered and cured constituting the tea of commerce. In its cultivated state it is a bushy shrub a few feet high with numerous very leafy branches bearing white, slightly fragrant flowers in small clusters and a woody capsular fruit of three cells, each containing a single large seed. Numerous varieties have arisen through long cultivation. In production Japan, with Formosa, ranks first; China, second, and India, including Ceylon, third. In China tea culture is believed to be prehistoric; in Japan it was established in the early Middle Ages, but in India and Ceylon tea growing, now very extensive, dates from about 1870.

Tea, used by a larger number of people than any other beverage, owes its popularity to the presence of theine, an alkaloid with stimulant and tonic properties. In chemical composition this alkaloid is identical with caffeine, the essential principle in coffee, cocoa, cola and mate. A. B. J.

Classes and Uses. The two classes of teas, green and black differ in treatment after picking, black teas being fermented before drying. Chinese teas are graded with reference to position of the leaf on the stem. Flowery orange pekoe, very choice and seldom exported, contains the leaf buds; orange pekoe, the youngest leaves next the bud; pekoe, those next; and souchong first next. Grades vary because teas are sorted according to leaf grade, not variety. Teas imported into the United States are carefully tested for grade standard.

A fragrant, refreshing beverage is made by infusing tea leaves with boiling water. Heavy-body black teas are best for serving with cream; green teas a lighter and more delicate in flavor.

The process of steeping tea leaves with boiling water is called tea brewing. A heated earthenware teapot is preferable. The amount of tea used depends upon the kind or blend of leaves and upon person taste. The water should be fresh and briskly boiling. If it boils too long, the tea tastes flat; if it is not actually boiling, the stimulating property, theine, is not extracted. Tea should be steeped from three to five minutes and strained from the leaves immediately. Prolonged steeping or boiling extracts a large amount of tannin, producing astringency. M. S.

The statistics for the imports and exports of tea are as follows:

EXPORTS AND IMPORTS OF TEA IN 1929
(in thousands of pounds)

COUNTRY	1929	
	Imports	Exports
<i>Principal Exporting Countries</i>		
British India	8,461	388,491
Ceylon	251,491
Dutch East Indies	8,362	119,861
China	5,010	125,691
Japan	1,323	23,661
Formosa	92	18,481
<i>Principal Importing Countries</i>		
United Kingdom	465,659	...
United States	89,373	...
Australia	50,576	...
Canada	38,677	...
Netherlands	28,716	41
Irish Free State	23,580	...
Russia	63,030	...
New Zealand	12,061	...
Morocco	16,107	...
South Africa	12,095	26
British Malaya	11,378	1,211
Egypt	13,093	24
Germany	12,723	...
Chile	5,415	...
Poland	4,839	...
Argentina	4,213	...
Indo-China	4,313	2,23
France	3,492	6
Czechoslovakia	1,607	...
Austria	1,430	...
Yugoslavia	913	...
Hungary	841	...
TOTAL, 28 Countries	887,380	931,82

TEACHER. Teaching is one of the major professions. In the United States more than three quarters of a million persons are teaching in educational institutions ranging from the universities to nursery schools. The educational profession, taken in its broadest sense, offers a great variety of activities ranging from classroom teaching to psychological school nurse, superintendent of schools, and research worker.

Professional training is essential for teaching, the minimum requirement being now two years beyond high school. The better teacher-training institutions offer a four year course. The higher positions are seldom open to an applicant not having the equivalent of the master's or the doctor's degree.

The teaching profession has become well organized. The National Education Association, together with hundreds of local organizations, care for the welfare of the profession. Certainty as to tenure of office, broad pension systems and steadily increasing salary schedules have, during the past decade, made the profession of teaching more secure and remunerative. In the past years teaching, as distinct from the direction positions, has drawn a preponderance of women, but now more men are entering the various teaching fields. At the present time it offers to both men and women a dignified, socially accepted and financially secured career of public service.

R. G. R.

TEACHERS, PREPARATION OF. Except for isolated examples attention to the preparation of teachers began to be given only with the development of national systems of education in the 19th century. It was first seriously organized in Germany whose example exercised a strong influence on its provision in the United States, although the name of the institution giving that preparation, normal school, was borrowed from France. The first normal school in the United States was opened at Lexington, Mass., in 1839, being founded by HORACE MANN. The progress of teacher preparation was comparatively slow, and there are still too many teachers, particularly in rural schools, with no professional preparation at all. It is now generally accepted that the minimum standard of preparation for teachers in elementary schools should be two years beyond the high school. While this minimum is rapidly being attained, the increasing responsibility of the elementary school and the improvement in the financial and social status of teachers have made possible an extension beyond this minimum to three years in a number of states and to four years as in California. This increase in standards has been accompanied by the gradual transformation of normal schools into teachers' colleges, which offer four-year courses leading to a degree and providing facilities side by side with schools of education in universities for post-graduate work. There is thus the greatest variety of practices from high school training classes to teachers' colleges standardized by the American Association of Teachers Colleges. The problem of teacher preparation involves a suitable coordination of academic and professional studies and practice teaching. Institutional preparation is followed up by various types of training of teachers in service.

The gradual raising of the standards of preparation in the United States is paralleled by a similar movement in Germany, where the different states provide two- and three-year courses on a university level, and in England where the same standard has been adopted. Teachers in France are still being trained in normal schools below the university level. Practically

all the progress in teachers' preparation has been directed to the training of elementary school teachers. The preparation of secondary school teachers has lagged far behind, although Germany organized it over a century ago and France established her Higher Normal School in 1808. A university degree with or without a post-graduate professional course is the standard accepted in England. In the United States the minimum standard of preparation is a college degree with a few courses in education. California requires one year post-graduate of preparation. The preparation of college teachers is a subject which has only recently begun to be considered in the United States.

I. L. K.

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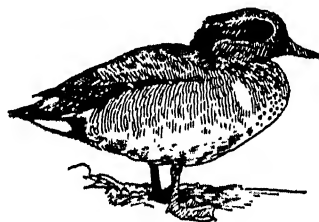
TEACHERS COLLEGE, COLUMBIA UNIVERSITY, a coeducational institution for the advanced study of and research in education. Founded in 1865 and chartered in 1889 to train teachers of manual and practical arts, the college was gradually expanded to include the training of all teachers. After 1898, when the college became affiliated with COLUMBIA UNIVERSITY, the foundations were gradually laid, under the guidance of Dean James E. Russell, for the encouragement and promotion of research in education on a university level. With the development in the country of other centers for the study of education, Teachers College gradually adopted the requirement of a degree for admission. In 1915 the college became a constituent part of Columbia University with its president as the executive head *ex officio*. The college, however, has its own Board of Trustees responsible for its maintenance and is under the administrative charge of a dean. The college to-day includes a Faculty of Education and a Faculty of Practical Arts, which are recognized faculties of Columbia University; the Institute of Educational Research, 1921; the International Institute, 1923; the Child Development Institute, 1924; the Institute of School Experimentation, 1928, and the Institute of Practical Arts Research, 1930. The courses in the college lead to degrees conferred by Columbia University and diplomas granted by the college. Two schools, the Horace Mann School and the Lincoln School, are associated with the college for demonstration and experimental purposes. The productive funds in 1931 amounted to \$7,544,292. The library contained more than 150,000 books. The total number of students in 1930-31, including those in the regular academic and in the summer session, in Teachers' College, was 13,867. The faculty numbering 367 was headed by Dean WILLIAM F. RUSSELL.

TEAGUE, a town of northeastern Texas, in Freestone Co., situated about 50 mi. east of Waco. The Burlington-Rock Island railroad affords transportation. Teague deals in the agricultural produce of the region, and has manufactures of cottonseed oil. Coal mines are located nearby. Pop. 1920, 3,306; 1930, 3,509.

TEAK—TEAPOT DOME SCANDAL

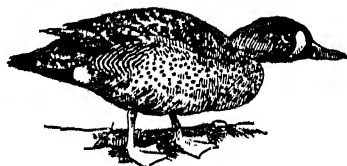
TEAK (*Tectona grandis*), a magnificent forest tree of the verbena family highly valued for its durable timber. It is a native of southeastern Asia where it originally formed immense forests, especially in India. The tree, which sometimes grows 150 ft. high with a trunk 8 ft. in diameter, bears large, oval, deciduous leaves, numerous white flowers in terminal clusters and globular fruits, about the size of cherries, containing oily seeds. The very hard heavy wood, which sinks in water unless thoroughly dried, is extensively used for ship building, furniture, wood carving and construction work. Among commercial hard woods teak ranks next in value to mahogany, which it somewhat resembles. Since the exhaustion of the natural forests teak plantations have been established in India, Burma and Java.

TEAL, the common name for a group of small, short-necked, dabbling ducks, highly prized as game birds. There are about 15 species widely distributed throughout the world. They frequent marshes, ponds and streams, feeding chiefly upon water plants, seeds and insects, and nest often at some distance from the water, laying greenish or cream-colored eggs. In North America the most common species is the green-



DRAWING BY GEORGE MIKSCH SUTTON
GREEN-WINGED TEAL

winged teal (*Nettion carolinense*), found throughout the continent. This duck is scarcely more than a foot long, the male having a chestnut head and neck, a glossy green patch behind the eye, a bright green wing band, and black and white underparts. It becomes excessively fat and of all wild ducks its flesh is one of the most delicious. The blue-winged teal



DRAWING BY GEORGE MIKSCH SUTTON
BLUE-WINGED TEAL

(*Querquedula discors*), a somewhat larger bird, the male with a white crescent on its gray head, brown spotted underparts, and wings marked with blue and a bronzy green band, is very common from the Atlantic Coast to the Rocky mountains. From southern Canada and the western states southward to Chile is found the cinnamon teal (*Q. cyanoptera*), one of the

most abundant of western ducks. It has chiefly cinnamon-colored and dusky plumage with blue and green wing markings.

TEA-OIL TREE (*Camellia Sasanqua*), a small shrubby evergreen tree of the TEA family with high ornamental flowers and foliage. It is a native of China and Japan where it is extensively grown and its seed yielding an oil similar to olive oil much used in China in cookery and for various other purposes. After expressing the oil the seed-cake, which contains the poisonous glucoside saponin, is used like a mild soap for cleansing delicate fabrics; it is also employed to stupefy fish in ponds and still water so that they may be readily caught. Several varieties of the tree are grown for ornament. See CAMELLIA

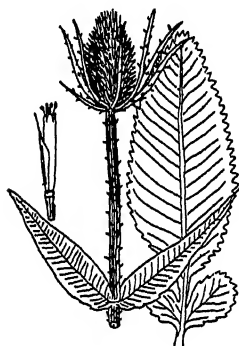
TEAPOT DOME SCANDAL, malfeasance in connection with the leasing of Federal oil reserves to private individuals, involving members of President Harding's cabinet and other Government officials. Investigations by a sub-committee, headed by Thomas J. Walsh, of the Senate Public Lands Committee in 1923-24, of the leasing by Secretary of the Interior Albert B. Fall of a reserve in Wyoming known as the Teapot Dome (after a physiographical feature) to interests headed by Harry F. Sinclair, and of a reserve in California to interests headed by Edward L. Doheny, revealed that oil interests had lavishly supported Harding's campaign for the presidency; and that Doheny on Nov. 30, 1921 about five months before he was awarded the lease of Teapot Dome, lent Secretary Fall \$100,000 on an uncured note without interest. Reporting in Jan. 1924 the committee denounced Secretary Fall, condemned Secretary of the Navy Edwin Denby for negligence, authorizing the transfer of naval oil reserves in California to the Secretary of the Interior, and criticized the methods of both these officials in the diversion of Federal reserves to private operators. A minor report, signed by five Republican members of the committee, attempted to vindicate Denby and assign full responsibility for the malpractices to Fall, eligible for odium since he had retired from the Cabinet Mar. 4, 1923. The Senate adopted the majority report. Coolidge belatedly consented to demand Denby's resignation in Feb. 1924. Because the Attorney-General, Harry M. Daugherty, was discredited and unacceptable to Congress, legal action against Doheny and Sinclair was instituted by special counsel named by the President. Civil action for recovery of the leases and for damages was successful. Criminal action against Doheny for perjury failed in a series of trials which were marred by rumors that the defendant had tampered with the jury. Sinclair served 6 months and 14 days in prison after conviction for contempt of the Senate and for tampering with jurors. In 1931 former Secretary Fall, having exhausted avenues of appeal from a sentence of one year in prison and a \$10,000 fine, for accepting a bribe from Doheny in connection with the Elks Hill leases, entered the New Mexico penitentiary. He was released on May 9, 1932.

TEAR GAS. See CHEMICAL WARFARE.

TEASDALE, SARA (1884-), American poet, was born at St. Louis, Mo., Aug. 8, 1884. She was educated at private schools in St. Louis, and then traveled extensively in Europe and the Near East. Her first volume published was *Sonnets to Duse*, but not until *Helen of Troy and Other Poems* appeared were her rich lyric gift and delicate craftsmanship revealed. *Rivers to the Sea* won her a yet wider recognition. Among her later works are *Love Songs* and *Flame and Shadow*.

TEASEL, the common name for a genus (*Dipsacus*) of stout, prickly or rough-hairy biennials of the teasel family. There are about 15 species, natives of Europe, Asia and north Africa, two of which have become naturalized in North America. The fuller's teasel (*D. fullonum*) is extensively grown in Europe and to a limited extent in central New York for the ripe flowering heads or "teasels." The cylindrical heads, 3 to 4 in. long, densely beset with rigid spiny scales ending in a hooked tip, are used in machines for fulling (raising the nap on) cloth. The common or field teasel (*D. sylvestris*) of Europe is widespread as a weed in the eastern United States.

TEA TABLE, a small table used for the making and service of tea. Its history begins with the introduction of tea drinking into Europe in the 17th century, and Samuel Pepys records that tea was still a novelty in England in 1666. The early designs were for the most part tables of the tripod variety, with small rectangular tops. Those with hinged tip-tops enjoyed a great vogue as they could be folded and put away. In the William and Mary period walnut, marquetry and lacquer were favored. A turned center shaft supported by three cabriole legs, handsomely carved, became the rule under Queen Anne, and drop leaf tables of all shapes and sizes were in use. THOMAS CHIPPENDALE originated the separate tray top and the pie-crust variant. Tea drinking soon became popular in the American colonies, and the development of the tea table progressed on both sides of the Atlantic. With the Classic Revival, the elaborate carving, cabriole legs and ball-and-claw feet gave way to plainly turned baluster shafts, and spade and small



P. A. RYDBERG,
AND PLAINS'

TEASEL
Dipsacus sylvestris



TRIP-TOP TEA TABLE SHOWING
CHIPPENDALE INFLUENCE
Made in Philadelphia in the
latter part of the 18th century

paw feet. Mahogany and other woods were used along with the ubiquitous walnut, and the tea table showed the changing characteristics of the periods that followed. In France, tea drinking was never popular, but *tables à thé* were widely used under Louis XVI. They were small and rectangular, usually surmounted with low metal railings, and in effect were little more than occasional tables.

TECHNICIAN, one who is skilled in technical procedures, or in the execution of a complex operation of a scientific, artistic or mathematical nature. The aptitude of a technician is generally for the practical rather than for the theoretical aspect of a matter, though frequently the first rate SCIENTIST or musician is also a very skillful technician. A skilled LABORATORY WORKER who has received training in the theory of a single specialty but who still works under the direction of a scientist or a TECHNOLOGIST, is generally spoken of as a technician. This calling demands meticulous care with detail, combined with unlimited patience and a high coordination of hand and eye. A technician must be responsive to competent supervision. When combined with executive ability, the training and experience of a technician may lead to the position of director in a testing or research laboratory, or to that of chief draughtsman.

TECHNOLOGICAL UNEMPLOYMENT, a recent term used to designate unemployment arising from technological changes in production, and especially from the introduction of machinery. The term arose and controversy concerning it was carried on particularly in the United States after 1922, when increase in the efficiency of production was extraordinarily rapid. Conservative economists pointed out that the introduction of better machinery ultimately results in enlarged employment, since by cheapening products it tends to enlarge the demand for them. Workers who lose their jobs in one industry, it is contended, find others in new or expanding industries. Although in certain industries, like motor manufacture in the United States, the market expanded so rapidly that in spite of greatly increased productivity the volume of employment increased for a number of years, many workers in other industries did lose their jobs when new machinery was introduced, the specific market being less elastic. There is little doubt that, whatever the ultimate effect, a period of rapid technical changes does bring a necessity for a great deal of shifting about of labor, so that even if those displaced do eventually find other occupations, the amount of unemployment is at least temporarily increased. Studies have revealed that many were out of work for months at a time, and that those who found jobs elsewhere frequently suffered a reduction in pay. It is also maintained that the readjustments in prices and incomes necessary to bring about the consumption of enough larger total output to absorb the increased capacity of industry are so long delayed that crises of unemployment are produced by rapid technical improvement. There is, however, little scientific support for the popular theory that

the introduction of machinery causes a progressively growing volume of unemployment over a long series of years. See also UNEMPLOYMENT. G. S.

TECHNOLOGIST, a person who has acquired a sound practical knowledge of the facts and principles involved in one or more branches of the industrial arts. Metallurgists, weavers and builders are examples of technologists. The technologist is not only versed in the details of each individual step in a process of manufacture but is master of the process as a whole. However, a technologist is not concerned with the handling of details and does not necessarily possess skill in the handling of tools and instruments as does the **TECHNICIAN**. It might be said of the technologist that he arranges to produce that which the engineer conceives; he is essentially a manager and supervisor of technological processes.

TECUMSEH (c. 1768-1813), American Shawnee chief, was born near the site of Springfield, O., probably in 1768. In middle life Tecumseh realized the consequences of the slow advance of the Whites and in 1808 began organizing the Indians to defeat them. With his brother Tenskwatawa, the Prophet, he founded a model Indian town on Tippecanoe Creek, Ind., as a base, worked among the Indians of the Illinois country, and then crossed the Ohio to organize the southern Indians. While he was absent Governor William Henry Harrison defeated his Indians and destroyed the town at the Battle of Tippecanoe, Nov. 7, 1811. During the War of 1812 Tecumseh threw in his lot with the British. He was commissioned a brigadier general, fought at Detroit and in the siege of Ft. Meigs, and was killed in action at the Battle of the Thames in Ontario, Oct. 5, 1813.

TEDDERS, a machine used in haymaking to fluff up the swath and facilitate curing. Two pronged forks attached to a crankshaft across the rear of the machine give the hay a lifting and pitching effect. The entire device is mounted on two wheels, both of which act as drivers.

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TEELE, RAY PALMER (1868-1927), American economist, was born in Fillmore Co., Minn., Oct. 22, 1868. He was graduated in 1897 at the University of Nebraska and the following year became an economist of the U.S. Department of Agriculture, in the service of which he became a leading authority on irrigation and drainage. He wrote numerous government reports and published independently *Irrigation in the United States* and *The Economics of Land Reclamation in the United States*. He died at Myton, Utah, Aug. 27, 1927.

TEETH. Though two sets of teeth appear during the life of a human individual, the first set deciduous or milk teeth (Fig. 1)—is entirely lost by the thirteenth year, and contains a smaller number than the second set—permanent teeth (Fig. 2).

A typical tooth consists of a crown (C. in Fig. 3), which is the portion projecting into the mouth; one or more roots (R.) which are conical pegs fitting into

cavities in the bones of the jaws; and a short, slightly constricted neck (N.) connecting the two portions just described. Each tooth, however, presents anatomic points which enable it to be identified. There are thirty-two teeth in the adult, and thus eight in each side of a single jaw, upper or lower. Of these eight the two nearest the mid-line, are termed incisors; the next one, canine; the next two, premolars or bicuspid; and the last three, molars.

The incisor teeth (In.) have a wedge-shaped crown whose outer (buccal) surface is somewhat convex and whose inner (lingual) surface is triangular and slightly concave. At the apex of the triangle is usually a small elevation, the cingulum. The upper incisors are considerably broader on their biting or occlusal edges than are the lower ones. This causes each lower tooth to appear to be shifted in such

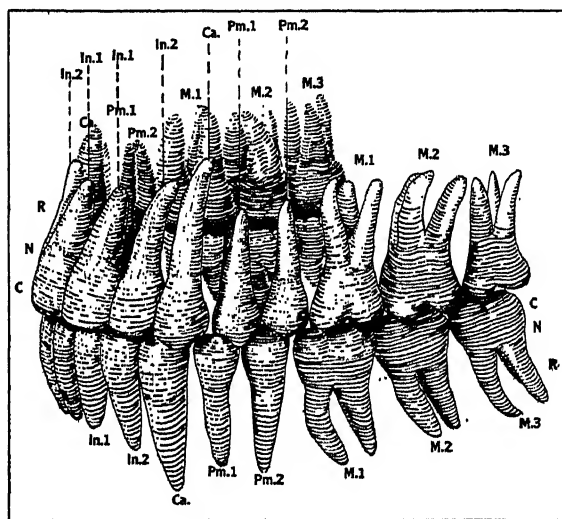


FIG. 1. TEETH OF THE HUMAN ADULT IN THEIR NATURAL RELATION TO ONE ANOTHER

In., incisor; Ca., canine; Pm., premolar; M., molar; C., crown; N., neck; R., root

manner that a cusp of a given lower tooth fits into depression of its corresponding tooth in the upper jaw, or into the interval formed by two adjacent teeth. There is thus formed an occlusal pattern which if disturbed or improperly developed, may lead to further dental difficulties.

The third or canine tooth (Ca.) has a large pointed crown, and a very long root, slightly flattened from side to side. The succeeding two teeth or premolars (Pm.) have a somewhat cylindrical crown terminating in two cusps, with a deep groove between, hence the name bicuspid. The roots are usually single, but may be cleft on the ends. The molars (M.) have heavy, rather cubical, crowns, flattened on their biting surfaces. From three to five cusps are present on each, the number depending upon their location. Each has three roots which diverge somewhat. The last molar is popularly called the wisdom tooth, because it does not erupt until about the twentieth year. Its roots may be fused.

There are only twenty deciduous teeth. Thus there are five in one half of each jaw. The two nearest the mid-line are incisors, the next one is a canine, and the last two are molars. In general, they resemble corresponding adult teeth, but are, of course, smaller, and the roots of the molars diverge more (Fig. 2).

The chief bulk of a tooth is a hard substance called dentin (Fig. 3, *De.*). It resembles bone in that it is approximately three-fourths mineral matter, but its structure is not like that of bone. The solid matrix is perforated by myriads of extremely fine canals, radially disposed, called dentinal tubules. These curve somewhat, and frequently branch.

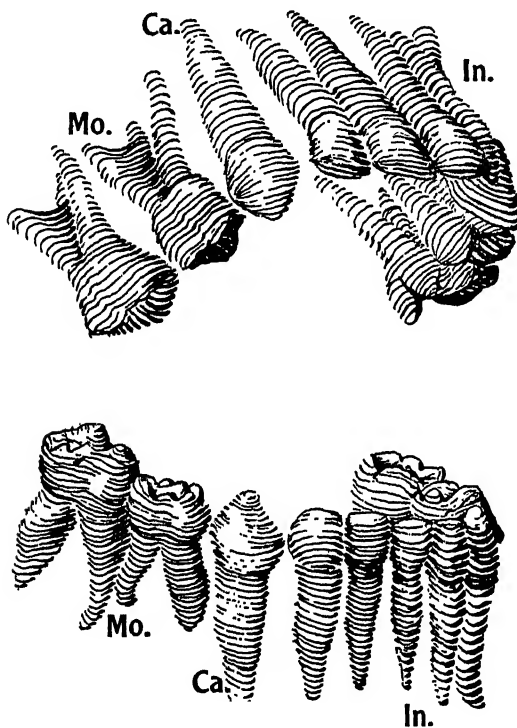


FIG. 2. DECIDUOUS TEETH IN THEIR NATURAL RELATIONS
Mo., molar; Ca., canine; In., incisor

The interior of the dentine is hollowed out to form an elongated pulp cavity, occupied by the dental pulp (*Pu.*). In it ramify the blood vessels that nourish the tooth, as well as the nerves that give it its well-known sensitivity. Between pulp and dentine is a layer of cells called odontoblasts, which send long projections into the dentinal tubules.

The surface of the portion of dentine forming the crown is covered by a layer of enamel (*En.*), thick near the apex, and terminating just below the line of the gum (*G.*). This substance, the hardest in the body, is practically entirely mineral matter. It is formed of extremely fine polygonal prisms, arranged radially and fitting closely together.

Immediately outside the dentine of the root portion is a thin layer of cement (*Ce.*), which exactly resembles BONE in composition and in microscopic structure. A layer of CONNECTIVE TISSUE, the peridentum (*Pe.*), intervenes between the cement and the bone of the jaw (*Bo.*). This is composed of collagenous fibers running in various directions, but chiefly radially, attaching the tooth firmly to the bone of the jaw.

The development of teeth takes place in the embryo in the following manner. A horseshoe-shaped flange, formed of the covering epithelium of the mouth cavity, grows deeply into the soft tissue on which it rests. Knob-like thickenings appear at intervals on the inner

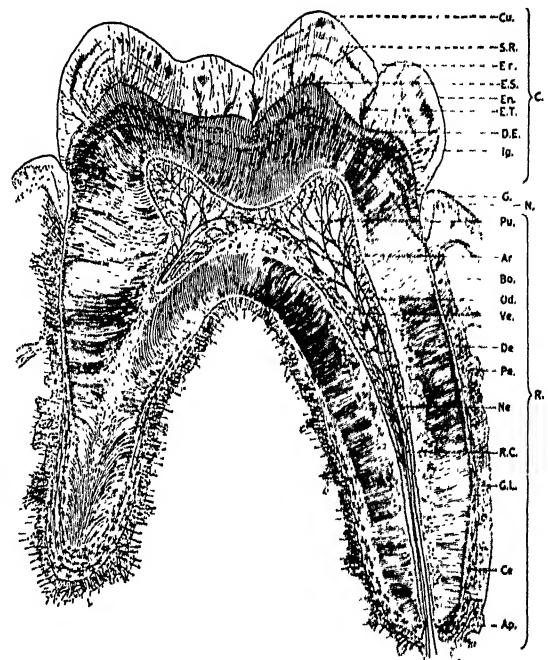


FIG. 3. LONGITUDINAL SECTION OF HUMAN MOLAR TOOTH
WITHIN ALVEOLUS

Ap., apex; Ar., artery of pulp; Bo., bone of alveolus; C., crown; Ce., cementum; Cu., cusp; De., dentine; D.E., dentino-enamel junction; Er., eroded pit in enamel; E.S., enamel spindles; E.T., enamel tufts; G., gum; G.L., granular layer; Ig., interglobular spaces of Tomes; N., neck; Ne., nerve; Od., odontoblasts; Pe., peridentum; Pu., pulp; R., root; R.C., root canal; S.R., striae of Retzius; Ve., vein of pulp; En., enamel

wall of this plate (Fig. 4, A), which on enlarging encounter a localized condensation of the soft tissue below. These condensations, the dental papillae, correspond in number and position to the tooth buds referred to. If the bud is to expand further, it must surround the papilla. This it does (Fig. 4, B, C), forming a cup around it. The original attachment of the cup narrows and separates from the flange (D). The inner wall of the cup develops a specialized layer of cells in contact with the dental papilla, and the outer wall of the papilla forms another layer in contact with the one just referred to. Each layer begins to form a stratum of substance from its surface which is in contact with the opposite layer (*e*). The deposit

formed by the cup becomes the enamel, the other becomes the dentine. With further growth, the tooth is gradually completed and begins to appear through the gum.

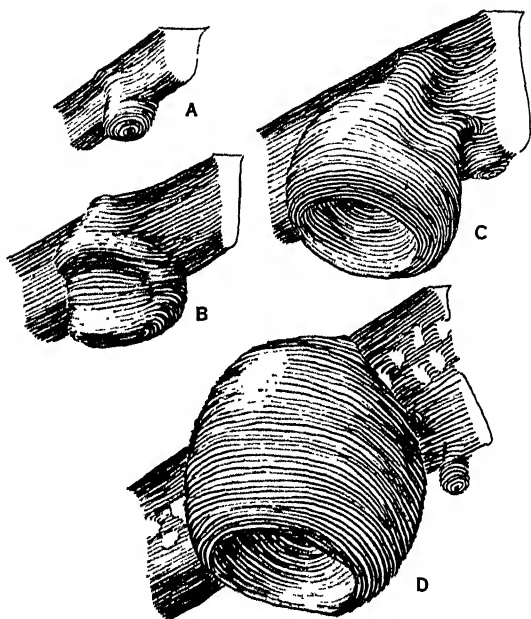


FIG. 4. STAGES IN THE DEVELOPMENT OF THE ENAMEL ORGANS WHICH FORM THE ENAMEL OF THE TOOTH

The ages at which the teeth appear are as follows. (The abbreviations correspond to those of Fig. 1 and 2: D = deciduous, P = permanent.)

Nine months	D In. 1 appears.
One year	D In. 2 appears.
Two years	D Ca. and D. M. 1 appear.
Three years	D M. 2 appears.
Six years	P M. 1 appears behind D. M. 2.
Eight years	P In. 1 appears; D In. 1 lost.
Nine years	P In. 2 appears; D In. 2 lost.
Eleven years	P Pm. 1 appears; D. M. 1 lost.
Twelve years	P Pm. 2 appears; D. M. 2 lost.
Thirteen years	P Ca. replaces D Ca; P M. 2 appears.
Twenty years	P M. 3 appears.

The mouth is developed from an inpocketing of the body covering, and teeth are specializations of the scales covering lower animals. This origin is evident in the lower fishes, where one can observe the gradual transition between body scales and teeth. The dentition of most animals is founded on a standard primitive type consisting of 44 teeth. Various modes of life and different diets have caused changes in the various groups which follow certain principles. Thus, flesh-eating animals have long canine teeth and sharp molars. Grazing animals may have sharp incisors, and possess small canines and large flat molars. Dentition is frequently used as a guide in tracing relationships of animal groups. See also DENTISTRY; MOUTH, DISEASES OF; SKULL.

TEETH, HUMAN, ANTHROPOLOGICAL ASPECT OF. Human teeth are of anthropological interest because of their evolutionary, developmental and racial significance. The features usually taken into account refer to number of teeth, their form, size, position and occlusion. All these features are of ancient origin. The adult human dentition, composed of 32 teeth, is derived by reduction from the more primitive mammalian dental formula consisting of 44 teeth. That this reduction occurred at a remote geologic time is shown by the dentition of the progressive tarsioid primate *Microchoerus* from the upper Eocene. The fundamental form of the primate teeth was acquired in the earlier Middle Eocene. Numerous primates of that time, typified by *Pronycticebus*, already had added on a fourth cusp to the original triad of the upper molars and a fifth cusp on the posterior border of the lower molars.

Progress in the human direction is first shown by the dentition of the primitive anthropoid *Dryopithecus* from the Miocene of India and Europe. Of the pre-molars in this ape's dentition the uppers have become bicusped and similar in form; the lower anterior is still compressed and incipiently bicusped and the posterior definitely bicusped, tending to become molari-form. The upper molars have four conical cusps, have lost the crested shearing form and the proto- and metaconules. Basal contact has been made by the proto- and meta-cone ridges forming the oblique ridge. The lower molars increased in width in proportion to length, the cusps as in the upper molars are conical, their ridges rounded. The position of the anterior pair of cusps remains transverse, while that of the posterior pair is changed to obliquely transverse, the inner cusp being posterior to the outer. The fifth cusp is prominent, conical and located obliquely behind the posterior outer cusp. The lowering of the anterior portion of the tooth crown, the leveling of the masticating surface, the conical cusps, the deep sulci between them, the basal contact of the anterior inner and posterior outer cusp ridges replaced in the lower molar the primitive tuberculo-sectorial by the *Dryopithecus* pattern.

The earliest complete human dentition is found in the fossil skull of *Homo mousteriensis hauseri*, a youthful member of the Neanderthal race. Its fundamental features, comprising number and form of teeth, number and form of cusps, ridges, grooves and occlusion, show a remarkable resemblance to the primitive anthropoid. In these respects *Dryopithecus* is nearer to the primitive human stage than to the earlier primates. Advances in the dentition of the Mousterian youth are shown in the lower pre-molars the posterior of which is more molariform and the anterior completely bicusped. The lower molars retaining the *Dryopithecus* pattern of cusps and groove are broadened more than in *Dryopithecus*. The fifth cusp is large, the third molar showing a tendency toward degeneration, delayed eruption and eventual disappearance. The changes in dental arch form are profound and significant. The narrow anthropoid

jaw with its parallel rows of cheek teeth is widened and shortened in man. The anterior part of the alveolar border is crowded backward and the front teeth are no longer procumbent but vertical. The lower canines, reduced in size, are withdrawn beneath the closed up row of upper front teeth. The elimination of the anthropoid gaps, the diastemata, for the accommodation of the long canine tips, the transverse shrinking of the forepart of the dental arch and the inward inclination of the lower pre-molars produced the paraboloid dental arch form attained in the Pleistocene species of man.

The teeth of modern man are simplified in form and reduced in size. Simplification and reduction is also apparent in number and form of cusps, ridges and grooves. In the upper second and third molars the postero-internal cusp is reduced or absent. In the lower second and more rarely in the third molars the number of cusps is reduced to four. Their contour is rounded and the *Dryopithecus* pattern of cusps and grooves is changed to the cruciform pattern. The size of the molars decreases from the first to the last. This is in reverse order from the primitive and the anthropoid ape condition. Delayed eruption, reduction in size and total disappearance of the third molars; reduction in size, change in form and total disappearance of the upper lateral incisors; delayed or suppressed eruption and displacement of the canines; reduction in size and simplification in form of lower anterior premolars; reduction in size of upper posterior premolars; simplification in form and frequent disappearance of lower posterior pre-molars; and malocclusion of the teeth in general: these are distinguishing features of the dentition of modern man.

In the development of the individual the teeth are conspicuous by the manifestation of sexual, racial and economic differences. The dental equipment of man is furnished by two sets of teeth, the temporary and the permanent. Their beginning dates back to embryonic life. They become of account when emerging or erupting through the gums. The eruption of teeth divides the first two decades of life into four periods: (1) *infancy*, the time involved in getting the temporary set of teeth; (2) *childhood*, when the permanent first molars appear and the temporary teeth are beginning to be shed; (3) *juvenile*, when the deciduous teeth have been shed and the second molars have erupted; (4) *adolescent*, when the third molars or wisdom teeth are making their appearance. The phenomenon of tooth eruption is affected by sexual, racial and economic conditions. Girls get their teeth earlier than boys; Negro children get theirs earlier than white children; poor children are slower to begin the tooth-getting period and quicker to end it than children of better situated parents. Climatic conditions seem to affect tooth eruption. Children of European Whites living in Hawaii erupt their teeth earlier than those living in Europe. Stature has a reverse relationship. Tall children erupt their teeth later than do small children of the same age. Feeble-mindedness accelerates the eruption of certain

teeth. It has also been observed that first-born children teeth earlier, and that children of parents of advanced age get their teeth sooner than those of younger parents.

The racial features of human teeth refer chiefly to their dimensions, number of cusps, type of groove pattern and artificial deformations. Mankind is thus divided into large-, medium- and small-toothed races. In the first group are included Australians, Papuans, Timoreans and Dschagga; in the second, Europeans; and in the last group are Egyptians and Burmans. In the large-toothed group cusp reduction is least frequent, and in the small-toothed group most frequent. Comparative studies of European Whites, West African Negroes and Central Asiatic Mongols show that reduction in number of cusps and change in pattern of grooves from the *Dryopithecus* to the cruciform is most frequent in the lower molars of Whites, and least in those of the Negroes, the Mongols being intermediate.

Artificial deformation of the visible front teeth by filing, chipping and completely knocking them out, is practiced by African Negroes, Australian aboriginals and Malays. Certain differences in the occlusion of the front teeth are usually taken as a racial character. The front teeth of the American Indian and those of the Australian aboriginal meet in an edge-to-edge relation. Among Chinese and Japanese the upper front teeth overlap the lower excessively. In the European, a slight overlap is the normal, although their actual variability is from edge-to-edge to excessive over-bite. The dental arches, as a whole, project forward most in the Australian and the African and least in the European.

M. H.

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TEGNER, ESAIAS (1782-1846), Swedish poet, was born at Kyrkerud, Nov. 13, 1782. He studied at the University of Lund, where he subsequently became professor of Greek. Still later he was made Bishop of Wexio. In 1808 he wrote his *War Song for the Militia of Scania*, and three years later was awarded the prize of the Swedish Academy for his patriotic poem, *Svea*. His best known work is *Frithjof's Saga*, a cycle of poetical romances based on the old Norse sagas. Among his other poems are *The Children of the Lord's Supper*, *Axel*, *Hymn to the Sun*, *Charles XII* and *Farewell to My Lyre*. Tegner's later years were clouded by insanity and ill-health. He died at Wexio, Nov. 2, 1846.

TEGUCIGALPA, the capital of HONDURAS, on the upper course of the Choluteca, 78 mi. from its seaport, Amapala. It is a white city spread in an up-

land valley plain, enclosed by wooded mountains and standing 3,400 ft. above sea level. It has a cathedral with two towers, a low-built university at the side of a tree-shaded plaza and a number of modern factories making shoes, hats, soap and candles. The city dates from 1650, owing its rise not to deliberate choice for strategic regions, like Comayagua, but because mines of silver and gold were found in the surrounding hills and valleys. The richest places of the Olancho valley had been exhausted, and Tegucigalpa, site of an Indian village, became the center of new mining enterprise, the Jesuits taking a leading part. There is no doubt that at one time this was a rich region. The cathedral and the old churches, to-day shabby and poorly kept but of generous design, were splendid in the days when this was the Potosí of Central America. There was and is plenty of food, cattle, fruit, maize and beans, as the public market testifies; but the entry of such luxuries as wines and fine silks is sadly diminished. When Spanish rule was overthrown many wealthy families returned to Spain; the Jesuits, expelled from their ancient properties, are said to have concealed the sites of many mines; and in such as remained open the freed Negroes refused to work. Several enterprising foreigners sought, and worked with a fair measure of success, veins of gold and silver during the last century. Pop. 1930, 40,049.

TEHRAN or **TEHERAN**, capital of Persia and of Tehran province, the city is situated on a tableland at the foot of the Elburz Mountains. The Caspian Sea is about 70 mi. north of Tehran. The high battle-mented walls which formerly surrounded Tehran were destroyed in 1869 and about 1874 enclosed by modern ramparts and a moat. The city is entered by a dozen imposing gates within which stretch endless rows of low mud-brick houses. Even the mansions of the wealthy classes are unimposing externally though they have courts with gardens and fountains fed with pure water brought from distant streams. The interiors of these wealthy mansions are elaborately furnished. The chief building is the Ark, or palace of the Shah, to which belong beautiful gardens, kiosks and luxurious baths. There are numerous other establishments and a military school. The life of the city revolves around the bazaars that are south of the Ark. The Maidan Tupkhaneh and the Maidan-i-Mashq are two vast squares used for military drill and as parade grounds. Wide boulevards planted with rows of white poplars lead from these squares and traverse the city. Among the notable mosques are the Masjid-i-Shad and the Masjid-i-Madar-i-Shah, both modern. Tehran is amply provided with educational institutions, there being schools for medicine, law, art, agriculture and industrial and political sciences.

Industrially the Persian capital is not important. Linen, carpets, hats and shoes are made here in rather small quantities. Many caravans come through Tehran, occupying as it does a commanding position for the routes leading to nearly all important points

in Persia. Used as a royal residence in the 17th century, Tehran rose to an important position in the latter part of the 18th century when the Agha Mohammed Khan selected it as the new capital. Under Nasr-ud-Din Shah in the later part of the 19th century Tehran was further embellished and renovated.

In the summer the climate of the city becomes almost unbearable and nearly all wealthy citizens and the foreign ministers go to the slopes of the mountains above the capital. The population which is estimated at about 250,000 is reduced by one-third during the summer season.

TEHUELCHÉ or **PATAGONIAN**, a South American linguistic stock called Tsonekan, represented by the Tehuelche tribe of Indians on the Patagonian plateau. They are now almost extinct but originally occupied the vast territory from the Rio Negro south to the Straits of Magellan. Their oversized stature and powerful physique created among many Europeans a tradition of a race of South American giants. Of necessity they have always been nomadic hunters and eagerly adopted the use of horses from the Spaniards in the 16th century. Ostriches, guanacos, wild fruits and tuberous roots are about the only items of diet afforded by the arid and wind-swept Patagonian plateau.

TELEGRAPH, the name given to communication between distant points by electrical impulses transmitted as signals in accordance with a code (*see* MORSE CODE). A telegraph system essentially comprises a source of electrical energy, a device for setting up impulses in an electrical circuit, lines for conducting the impulses to a distant point and a device for converting the impulses into sound or visual signals. The source of power may be either an **ELECTRIC BATTERY** or an **ELECTRIC GENERATOR**. The transmitting apparatus, in its simplest form, consists of a manually operated key, or switch, by which the circuit is alternately and rapidly "made" or "broken." The lines are similar to ordinary **TELEPHONE** lines. The receiving apparatus in its simplest form is a heavy arm oscillated against stops to produce distinctly audible clicks, or a similar arm having a pen or stylus attached so that it makes a record on a moving strip of paper. In both instruments, the moving arm is operated by an **ELECTROMAGNET** excited by the impulses of current set up by the transmitter.

Telegraph circuits may be either "open" or "closed." In the open-circuit type, the circuit is "made" when the sending key is depressed and current flows only while a message is being transmitted. In the closed-circuit type, the circuit is "broken" when the sending key is depressed and current circulates in the circuit continuously when the key is not being operated. The closed circuit is generally used in America, while the open circuit is used to a large extent in Europe. In either type of circuit, it is the universal practice to use the **GROUND** as the return conductor.

Telegraph lines may be operated as single-current or as double-current systems, either in open or closed circuit working. When single current is used, all

signals are sent by current moving in one direction, but, with the double-current operation, the current is reversed for signalling the spaces between the elements of a code.

To provide for economy in commercial telegraphy, various methods have been developed for transmitting more than one message over the same line simultaneously. *Duplex* operation is effected by two different types of circuits, the WHEATSTONE BRIDGE and the differential relay. In the differential duplex, the relay operating the receiver is rendered insensitive to outgoing impulses of current by a "differential" winding. In the Wheatstone bridge duplex system, the voltages of the bridge are equal for outgoing current and no current will pass through the relay. By combining a duplex system which operates on single current and responds to variations in current intensity, with one which operates on double current and responds to current reversals, a quadruple system is obtained. With this system, two messages may be sent in either direction over a single wire.

All telegraph circuits of any great length must be provided with "repeaters" to renew the strength of the impulses. These are essentially automatic keys which are operated by the weak impulses at the end of one section of the line and which set up new impulses of identical form in a subsequent section having a separate source of power.

The relays mentioned in connection with the receiving apparatus are identical in principle with the repeaters and operate to convert the weak incoming impulses into strong impulses for the operation of a sounder or recorder.

In modern telegraphy, the manually operated sending key and the sounder are little used, since they are slow and not conducive to accuracy. Most of the automatic systems utilize a perforated tape for operating the transmitter. Likewise, instead of receiving the message in code, a special machine receives the impulses and operates a printing device, called a teletypewriter. The code used in most of these modern printing telegraphs comprises five units for each character, and the automatic machines utilize five insulated segments in sending the code. Multiplex operation may be effected by these machines by using multiple sets of segments.

In utilizing telephone circuits for carrying telegraphic impulses, the two wires with ground returns may be used as two separate telegraph circuits. In this case, a network of CONDENSERS and INDUCTANCE COILS separates the high-frequency telephone current and the low-frequency telegraph current and directs them in their proper channels.

Another modern development in the transmission of telegraph currents is the use of ALTERNATING CURRENTS of different frequencies as different channels on the same line. Electrical filters at the receiving end exclude currents of all frequencies except the one in its particular channel, all channels being thus separated.

The history of telegraphy is as old as that of elec-

tricity itself, telegraph systems operating by static electricity being devised soon after it was discovered that substances could be electrically charged by friction. Notable among the early telegraphs was one having one wire for each letter in the alphabet, and utilizing the movement of charged pith balls as visual signals. Much development took place during the latter part of the 18th century and the early part of the 19th century, both the battery and electromagnet being developed in that period. However, it remained for SAMUEL F. B. MORSE to invent the telegraph in the form that is known to-day. He conceived the idea in 1832 and exhibited his first instrument in 1835. He succeeded in getting the government interested in telegraphy and money was appropriated for an experimental line between Washington and Baltimore. The government refused to buy the patents, however, and a private company was organized. This company constructed lines between New York, Washington and Baltimore in 1851, and the telegraph proved to be such a success that it was soon universally adopted. *See also* SUBMARINE TELEGRAPHY.

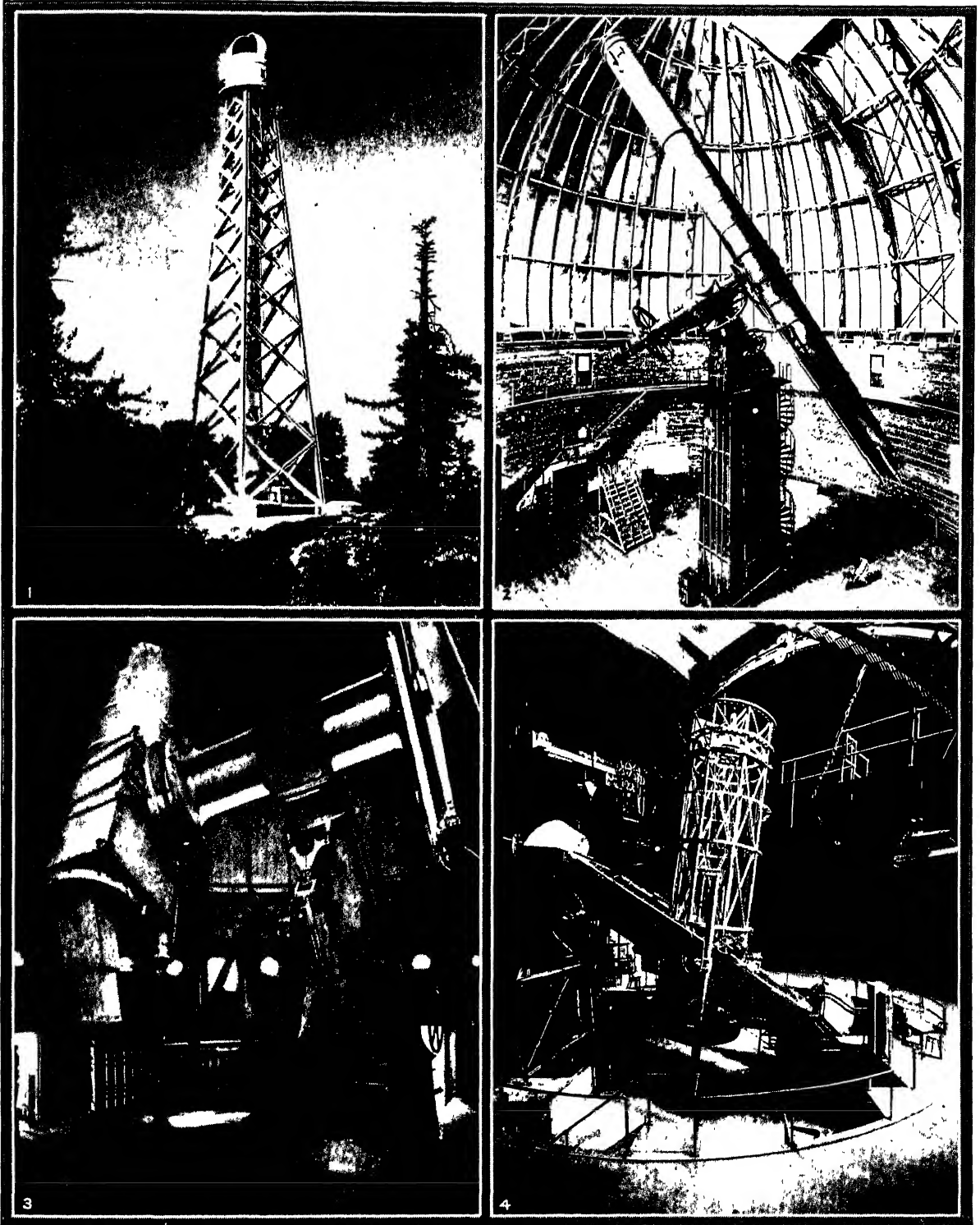
TELEGRAPH PLANT, an East Indian species of tick trefoil (*Desmodium gyrans*), a member of the pea family, called also semaphore plant. It is remarkable for the spontaneous movements exhibited by the small lateral leaflets of its trifoliate leaves. During the day, if the air is moist and the temperature above 72° F., the leaflets move alternately up and down at intervals of a few minutes with a jerking motion resembling that of the arms of a semaphore. During the night the leaves sleep drooping downward. *See also* SENSITIVE PLANTS.

TELEKINESIS, a term adopted by Charles Richet to describe the power claimed by mediums to move objects at a distance without ordinary means of contact. This includes lifting of tables, noises, raps and moving of heavy objects. It is regarded by him as a form of mechanical action transcending ordinary physics, just as clairvoyance and reading sealed messages transcends ordinary sensation. Critical examiners regard such phenomena as fraudulently produced.

J. J.

TEL-EL-AMARNA TABLETS, found on the site of the ruined capital of Ikhnaton, or Amenhotep IV, Pharaoh of Egypt, 1376-1362 B.C. They contain the official correspondence of Ikhnaton and his predecessor, Amenhotep III, with the ruling houses of Babylon, Assyria, Metanni, and various lesser princes of Syria, and together with the letters recently found at Boghaz-Keui, the site of the Hittite capital, reveal the extremely complicated political situation of the 14th century B.C. The various Mediterranean Powers were much more closely entangled than was realized before these tablets were found. The letters, 350 in all, of which about half are published, tell of alliances, royal marriages, trade treaties, embassies and all the paraphernalia of open and secret diplomacy, and show Egypt as the strongest power in the world at that time. They are written in Sumerian, the diplomatic language of the day.

TELESCOPE



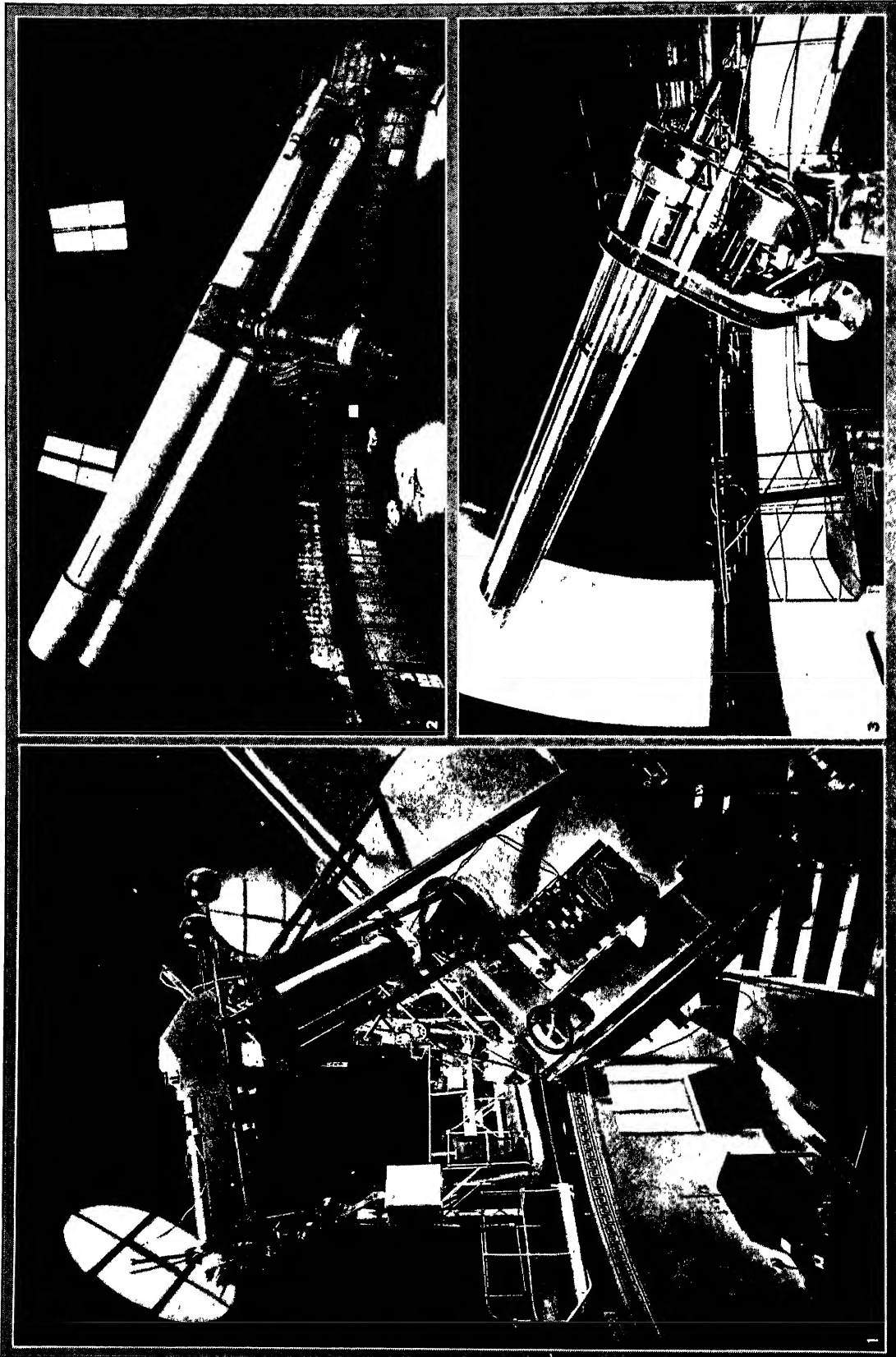
1, 4, COURTESY MOUNT WILSON OBSERVATORY; 2, YERKES OBSERVATORY; 3, ASTRONOMER ROYAL, GREENWICH OBSERVATORY

GREAT TELESCOPES OF ENGLAND AND AMERICA

1. The 150-foot tower of the Hooker telescope of Mount Wilson Observatory near Pasadena, California. 2. The 40-inch refracting telescope of Yerkes Observatory, Williams Bay, Wisconsin. 3. The 30-inch reflector at the

Royal Observatory, Greenwich, London, equipped with a camera for measuring the wave-length of the light of stars. 4. Reflecting telescope of Mount Wilson Observatory, with a mirror 100 inches in diameter. It was completed in 1919.

TELESCOPE

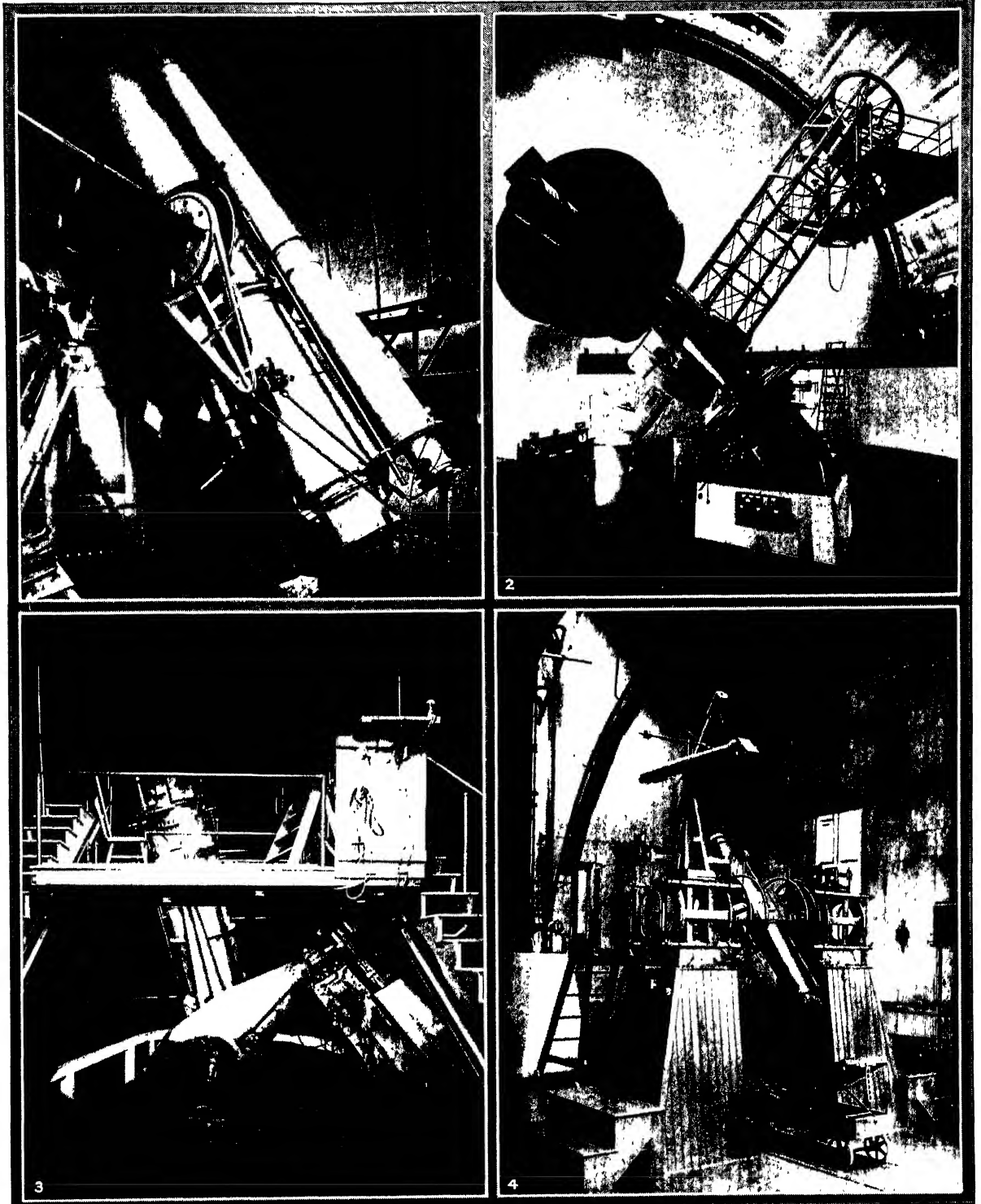


COURTESY CARL ZEISS, JENA, GERMANY

LATEST DESIGNS IN REFLECTING AND REFRACTING TELESCOPES

1. The 1.25 m. reflector with spectrograph at Berlin-Babelsberg.
2. The 650 mm. refractor in the dome of the observatory at Tokyo.
3. A 300 mm. refractor, with focal length of 5 mm., in the German Museum at Munich. Photo shows giant shutter open.

TELESCOPE



1. COURTESY ASTRONOMER ROYAL, GREENWICH OBSERVATORY; 2. DOMINION ASTROPHYSICAL OBSERVATORY, VICTORIA, B.C.; 3. LICK OBSERVATORY, CALIF.; 4. U.S. NAVAL OBSERVATORY

TELESCOPES AND OBSERVATORY APPARATUS

1. 26-inch reflecting telescope used for the determination of stellar parallaxes, Royal Observatory, Greenwich, London. 2. 72-inch reflector of the Dominion Astrophysical Observatory, Victoria, British Columbia. 3. The 36-inch

Crossley reflector of Lick Observatory on the summit of Mount Hamilton, California. 4. The 6-inch transit circle in the United States Naval Observatory, Washington, for calculation of time by the transit of stars.

TEL-EL-KEBIR, BATTLE OF, Sept. 13, 1882, an engagement fought by the British, under Lord Wolseley, against the Egyptians, commanded by Ahmed Arabi, the leader of the Arabi rebellion against British rule in Egypt. The British, with an army of 40,000, attacked Arabi's entrenchment, defended by 22,000 men. In this battle the British were able to suppress the revolt and restore the Khedive, who had fled, to his position of authority.

TELEMACHUS, in Greek mythology, son of ODYSSEUS and PENELOPE, and his father's successor as King of Ithaca. He was only a child when Odysseus started for Troy and on his subsequent wanderings, leaving his little son in charge of the faithful MENTOR. After many years Telemachus went in search of his father, visiting Pylos and Sparta in his journeyings. He returned to Ithaca just in time to meet Odysseus there and help slay Penelope's suitors.

TELEOLOGY, the theory of final causes, the doctrine that would explain things by their purpose. Teleology holds that there is some purpose in existence, that things do not happen by accident or by mechanical causation but because there is a purpose back of them that is somehow being realized. The doctrine is not satisfied with human purposes; it seeks a cosmic purpose. In the evolutionary process it sees an intelligence working toward ends it has set itself to achieve.

One of the great historical arguments for the existence of God is known as the teleological proof. It argues to the existence of a God from the order and design that appear in the universe. Kant, although admitting the argument was not coercive, nevertheless regarded it as the grandest and most sublime of all such proofs.

TELEPATHY, the ability to transfer and receive sensations and ideas, mainly in visual terms, at a distance or by some means beyond the recognized use of the senses. The term telepathy is convenient to indicate a possibility which if confirmed would lead to an explanation or theory of its operation. It constitutes a basic subject in PSYCHICAL RESEARCH upon which extensive literature has accumulated. A poll of psychologists disclosed but a small percentage who regarded the possibility as demonstrated.

The experimental evidence is most readily collected, and the calculation of the "successes" due to chance may in many instances be made quite definite. The most extensive experiments with varied material, such as conveying the numbers on lotto cards or the images of playing cards, were those of Professor Coover of Stanford University in 1917, and they were negative in result. Cases in which there was a strong subjective impression of being correct were actually no more so than when there was no such feeling. So-called sensitive, or "psychic," percipients were no more successful than others.

In several series by other investigators which showed successes beyond the allowance of chance, unconscious whispering and involuntary indications

were detected. But much of the material, though experimental, is not subject to precise calculation; it is in the nature of transference of pictorial images, diagrams or figures of objects, and in some instances in which the good faith of the participants is unquestioned, has yielded impressive results.

Spontaneous telepathy, such as PREMONITIONS and APPARITIONS, contributes a far more extensive and irregular body of evidence, subject to much error in interpretation. This, too, has been statistically considered with the result that while the great mass of it may be dismissed as negative or unevidential, a small group of instances remains that are not readily accounted for.

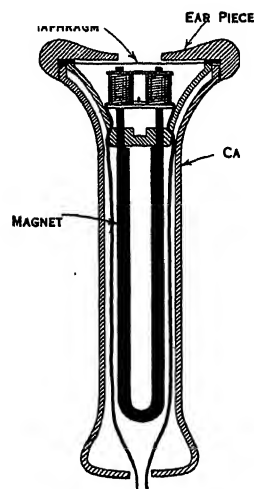
Telepathy becomes a rival hypothesis to spirit communication to explain the accessibility of mediums to private affairs known only to the sitters. Obviously if telepathy, even under exceptional circumstances, is possible, it becomes available as an hypothesis in many puzzling revelations recorded in the annals of psychical research. The fact that even horses were credited with supernormal powers, which on investigation proved to be the ability to follow slight involuntary indications, shows the delicacy of the processes which may be involved. Theories to account for the origin of such a power or its decadence and occasional survival are unsatisfactory.

J. J.

TELEPHONE, a system of communication by which sound is transformed into electrical impulses which travel along a conductor to a receiver where they are reconverted into sound to correspond with that at the transmitting end. The telephone is a development of the TELEGRAPH, in which the telegraph key was supplanted by the telephone transmitter or MICROPHONE and the sounder by the receiver. The microphone varies the RESISTANCE in an electrical circuit in correspondence with the FREQUENCY and intensity of the sound, thus converting sound waves into electrical impulses or waves. The receiver, conversely, converts the electrical impulses into sound waves. It comprises a strong permanent magnet on the poles of which are ELECTROMAGNETS. A metal diaphragm is held close to the MAGNETIC POLES and is caused to vibrate with the impulses set up at the other end of the circuit by the combined action of the two magnets. The electromagnet is operated by the impulses and opposes the "pull" of the permanent magnet. This vibration sets up sound waves corresponding with the speech at the transmitting end. Although simple in principle, the telephone as we know it to-day is a very complicated instrument embodying almost an untold amount of scientific development and technical knowledge. In the ordinary desk telephone, a comparatively simple piece of telephone equipment, there are 201 different parts.

When the telephone was first put into use a pair of phones were connected by a direct circuit and could be used for communication between two parties only. Then, in order to increase the useful range of the instrument, exchanges, or "call-clearing houses" were located in each community. The next step was to

connect the exchanges in different communities, then those in different towns and states, until there now exists a complicated network of lines and exchanges which enables a call to be put through from almost any point in the United States to any other point on the continent. Nor is telephone communication limited to American countries, since the radio service connects the phone system in this country to some of those which have been established in Europe and Australia. Telephone operators who collectively speak every civilized tongue are employed in the New York exchange which makes the foreign connections.



CROSS SECTION OF TELEPHONE RECEIVER

The telephone circuits or "lines" connecting the phones in this vast network fall naturally into the following classification: private or party lines connecting the individual phones

to an exchange; trunk lines connecting exchanges in the same city; and long distance lines connecting cities and, in the case of international communication, states and countries. Sometimes the private lines terminate at a switchboard or subexchange which is connected by cable to an exchange. This system is generally employed in business and commercial houses and apartments where a large number of phones are used. In rural or sparsely settled sections, two to five telephones may be connected on the same line leading to the exchange. "Lines" vary in size from a single circuit of two wires to large cables containing as many as 1,800 pairs of wires, connecting exchanges. Urban lines are usually installed underground and inter-city ones are suspended from poles, cables in the latter case being supported by a wire rope.

A call, say from a business house, will go to the subexchange where the operator will connect the private line of the calling party to a line leading to the switchboard in the exchange for that community. Here another operator receives the call and makes connection with the sub-exchange or private line of the party being called if the party is located within the vicinity of that exchange. If the party being called is in the district of another exchange in the same city the operator makes connection with that exchange and an operator there makes the connection with the proper private or sub-exchange line. In the case of inter-city calls, the call is directed to a "long distance" exchange where connection is made with the proper city, the proper exchange, sub-exchange and private line. Thus a private conversation may be carried on between two parties situated in remote corners of the country.

The series of connections which must be made are executed with great rapidity and facility, where the system is adequate to handle the volume of "traffic" demanded of it. Switching equipment to enable rapid connection between any two private telephones in the country is very extensive and complicated. As the receiver is lifted from the hook of private telephones, a tiny electric lamp signals the operator in the central office. She connects her phone to the line of the incoming call, receives the call and makes connection between the calling person's line and that of the party he is calling, ringing the bell at the receiving end to signal the party being called. The switching equipment enables the operator to make the connection with the proper outgoing line whether it is connected to her switchboard or with that of another operator. Such a system involves a complicated system of circuits and relays. The switches by which connections are made by the operator comprise a "plug" and a "jack." The plug comprises two separate and insulated parts, a tip and a sleeve, each connected to one wire of a circuit. Hundreds of these jacks are arranged in rows on the switchboard. The jack also comprises two separate and insulated parts, each connected to one wire of the outgoing circuit so that the plug, on being inserted in the jack, makes contact with the two parts to form connections between the two lines.

From time to time switching has been simplified by the aid of automatic mechanical devices, and in 1921 an exchange with complete automatic operation was installed by the Bell Telephone Company. In this system, invented by A. B. Strowger in 1889 and known as the step-by-step system, the switching is done by electromagnets, and the calling party "dials" the number he wants instead of giving it to an operator. In addition to switching equipment, telephone lines must be provided with amplifiers to increase the energy of the electrical impulses so that they may be transmitted over long distances. Amplification is done by a specially developed VACUUM TUBE. For long distance transmission the lines must be "loaded" to decrease the energy required for proper transmission of the electrical impulses. This is accomplished by introducing coils in the lines, the action of which is analogous to that of weight suspended from a vibrating cord. In the latter case the weight causes the string to vibrate longer and with greater amplitude of vibration; likewise the loading coils in a telephone line cause the impulses to retain their magnitude longer than they otherwise would. Provision must also be made for relaying these impulses over great distances, that is, adding energy to them to keep them from "fading" out. This is accomplished by vacuum tubes much as the amplification is effected. The original energy of the impulses is supplied by a STORAGE CELL battery at the exchange, an arrangement which has supplanted the individual DRY CELL battery for each telephone.

The history of the telephone is all contained within one generation, though the instrument has become a vital part of civilized business and social life. The

telephone was invented by ALEXANDER GRAHAM BELL in 1876 in a very crude and inefficient form which, together with a multitude of auxiliary inventions and developments provided the modern telephone. The first commercial switchboard permitting communication with more than one other party on a line was installed in New Haven, Conn. in 1878. In the succeeding years several independent companies were formed in various cities to provide telephone service to the public, but with few exceptions all these companies have been consolidated or interconnected with the Bell System of which the American Telephone and Telegraph Company is the parent organization. Good service has been provided the public and the development of the telephone has been rapid and great. In 1930 there were in the United States, 15,414,000 Bell-owned telephones, 4,683,000 Bell-connected telephones, and 136,000 not connected with the Bell system. The total number of 20,233,000 represents approximately 16.5 phones to every 100 people in the country. The investment in telephone plants and equipment amounts to \$4,227,000,000 and telephone companies employ 431,000 people, besides some 100,000 employed in manufacturing telephone equipment. Recent developments in telephony include commercial telephone service by radio connection to ships at sea. This was introduced on Dec. 8, 1929, the Leviathan being the first ship providing that service to its passengers. During the past few years telephone circuits have been increasingly used for connecting radio broadcasting stations into networks.

TELEPHOTOGRAPHY. The art of photographing objects at a great distance and it is generally implied that a method is employed which causes the objects in the picture to appear larger than if photographed by the usual CAMERA. In motion picture work the enlargement may be secured by the use of a long focus LENS. For ordinary picture work, however, the attainment of appreciable magnification by a long focus lens would require very bulky apparatus. Consequently the *telephoto lens* is employed, which consists of a PHOTOGRAPHIC OBJECTIVE combined with a well corrected negative lens. Such a combination permits an enlarged image to be obtained with a moderate bellows extension on the camera.

TELESCOPE, an instrument used to obtain an enlarged image of objects at a distance. There are two types: refracting telescopes which employ lenses, and reflecting telescopes which employ mirrors.

The originator of the telescope is not known with certainty, three men in Holland having claimed to invent it in 1608. GALILEO learned about it in 1609 and developed and improved it very much, finally making a telescope which would magnify 33 diameters. With this, Galileo discovered the satellites of Jupiter and revealed many other astronomical facts never before known. He was the first to use the name telescope for such a device.

Galileo's telescope, shown in Fig. 1, consisted of a long-focus convex lens as the object glass and a concave lens as eye-piece. Kepler was the first to sug-

gest the use of a short-focus convex lens as eye-piece, as in Fig. 2, and Huygens constructed instruments of this type. The Galilean telescope yields an erect image and has a relatively small field of view whose

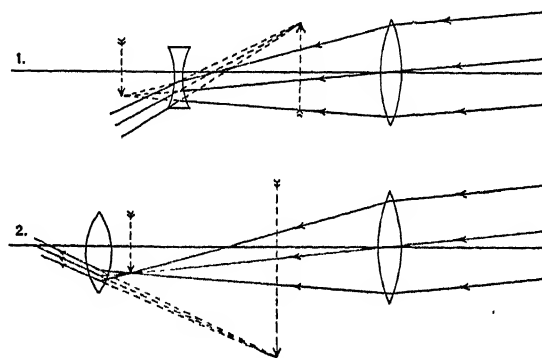
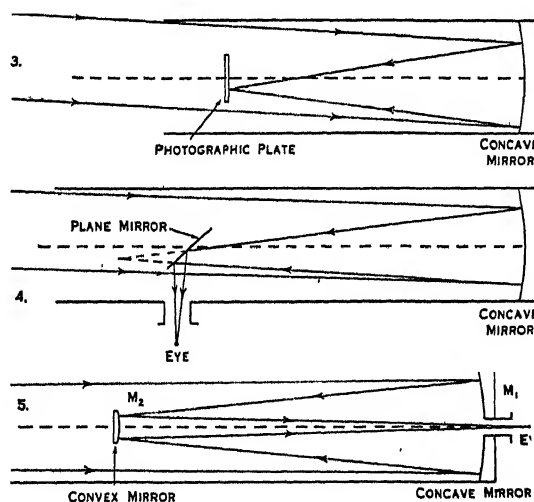


FIG. 1 AND FIG. 2

illumination falls off toward the edges; the Keplerian form produces an inverted image and has a large field of view, its sharpness of image however, not being as satisfactory as in the Galilean type. Modern opera glasses are essentially a pair of Galilean telescopes.

In the early types of refracting telescopes, the images were fringed with color, due to chromatic ABERRATION. Believing that this defect could not be remedied in any lens system SIR ISAAC NEWTON developed the reflecting telescope, employing a mirror of polished metal known as speculum, in order to eliminate the chromatic defects. Reflecting telescopes of the pres-



FIGS. 3, 4 AND 5

ent day are of three forms: first, one used for direct photography, in which the photographic plate is placed at the principal focus as shown in Fig. 3; second, the form due to Newton, in which a flat mirror throws the image out to the side as in Fig. 4; and third, the Cassegrain form of Fig. 5, in which a

convex mirror M_2 is placed on the axis so as to reduce the convergence of the beam from the large mirror M_1 , thus yielding a telescope of long focus. The light from M_2 is received on a plate-holder or SPECTROSCOPE immediately behind a hole in the center of M_1 . In order to correct for spherical aberration, the mirror M_1 is paraboloidal in shape and M_2 is hyperbolic.

Both types of telescopes, refracting and reflecting, are at present in use in astronomical work. The largest refractor, one of 40 in. aperture, is at the Yerkes observatory; the largest reflector, one of 100 in. aperture, at the Mount Wilson observatory. This latter telescope may be used either in the Newtonian or Cassegrain form. A reflector of 200 in. aperture is under construction at present. T. S.

Telescopes used in astronomy are invariably mounted as equatorials; that is they are so made as to rotate around two axes, one of which is placed parallel to the axis of the earth. Thus, in following a celestial object for a length of time, the telescope may be clamped with respect to the second, or declination axis, and merely rotated around the first, or polar axis. The addition of a driving clock, which regulates this rotation so as to compensate exactly for the rotation of the earth on its axis, then enables the observer to watch the same object for any length of time without touching the telescope. The magnifying power of a telescope is the ratio between the apparent diameter of an object as viewed through the telescope and as viewed with the unaided eye. The maximum magnification that can be used to advantage depends upon the aperture of the telescope, as does also the resolving power, that is the ability to separate clearly two objects very near together. W. J. L.

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TELESCOPIUM (gen. *Telescopii*), a small constellation between Sagittarius and Ara containing but two stars brighter than the fifth magnitude. See STAR: map.

TELESPHORUS, ST., listed by the *Gerarchia Cattolica* as eighth bishop of Rome, 125-136 (?), between Sixtus I and Hyginus; by some considered the ninth pope.

TELETYPESETTER, a device recently invented to set type by telegraph. It comprises a transmitter, receiver and typesetting machine. The transmitter consists of a perforator, a typewriter-like machine which perforates a type with a coded message; and a transmitting machine which converts the perforations into electrical impulses to be carried to the receiving end of the system. The receiver includes a receiving perforator which receives the electrical impulses and converts them into perforations in a receiving tape; a printer for printing the message; and a distributor. The distributor converts the perforations of the receiving tape into electrical impulses which operate electromagnets controlling the keys of one or more LINTYPES or INTERTYPES. The teletypesetter can be used to increase production and save labor in news-

paper offices. In book printing it is of advantage in that the perforated tape may be kept instead of type metal or electrotypes for producing reprints.

TELEVISION, the transmission of images to distant stations by electrical means, practically simultaneously with their occurrence.

Three steps are involved in achieving television: 1. the transformation of light into electrical signals; 2. the transmission of these signals to the point of observation; 3. the conversion of these signals back into light. The ability to perform each of these three steps sufficiently rapidly for television has come largely since 1925 with the development of a very sensitive PHOTO-ELECTRIC CELL and efficient vacuum-tube amplifiers.

In television, just as in motion-picture projection, continuous movements are perceived as such by means of a series of practically instantaneous views of the moving objects presented to the eye in rapid succession. In practice, the whole scene is not transmitted at the same instant, but is divided into a large number of small areas which are transmitted in sequence by a process known as "scanning."

Two methods of scanning are now in use: (1) "beam" or "flying spot" scanning, and (2) "direct" or "camera" scanning. Both methods use a rotating disc containing a single spiral of holes near its outer edge, and mounted on the shaft of a motor which runs at a constant speed, usually between 15 and 20 revolutions per second. This disc is usually known as a Nipkow disc, having been patented in Germany in 1884 by Paul Nipkow, who proposed using it in a system of television at that time.

Beam scanning is used for close-up scenes, indoors. Here the light from an arc-light passes through a lens, then through a rectangular aperture, then through the holes of the rapidly rotating scanning disc immediately behind it, and finally another lens which brings the light to a focus on the object to be "televised." The size of the aperture is such that only one hole is exposed at a time, and each hole in succession causes an intense narrow beam to sweep across the object in a horizontal direction. Succeeding beams illuminate adjacent portions of the object, and thus the whole object is completely scanned once in each revolution of the disc. At any instant, however, only one small area in each strip is illuminated. The light reflected from this area falls upon a series of photo-electric cells situated in front of the object, thereby causing the emission of electrons from the surface of the cells. The number of electrons emitted, and hence the current flowing in the cells, is proportional to the amount of light at any instant. As the beam moves across the object, the variation in the light reflected is registered by the cells as a similar varying electric current.

Direct scanning is generally used for outdoor scenes which are brilliantly illuminated, and is essentially the same as the previous method with the position of light and photo-electric cells reversed. An image of the scene is focused on the rotating disc, and a lens then concentrates the light passing through the

holes of the disc into a photo-electric cell. This cell, at any instant, receives the light from a small area of the image only, just as in the previous case.

Thus either method of scanning produces an electric current varying in accordance with the brightness of the corresponding portion of the scene. This is amplified by vacuum-tube amplifiers and is then either directly sent by wire to the receiving station, or else is used to modulate a high-frequency radio transmitter, and sent as radio waves to the receiving station, in a way similar to the usual broadcasting of sound.

At the receiving station, the images are usually reconstructed by the use of a scanning disc identical to the one used at the transmitting station in conjunction with a source of light, usually a neon lamp (*see* GASEOUS CONDUCTOR LAMPS) having a flat electrode whose intensity of illumination is directly controlled by the incoming signals. The observer looks at the neon lamp through the rotating disc and an aperture and sees at any instant a moving spot whose brightness corresponds to that of the light falling on the photo-electric cell at the transmitting station. If the two scanning discs, transmitting and receiving, are in synchronism (i.e., rotating in phase at the same speed), then the observer will apparently see not a single moving spot but a complete image, due to the persistence of vision. It is essential, however, that the two discs be in exact synchronism, for otherwise the image will not be steady. The synchronization of the discs is a problem in itself. If transmitting and receiving stations are close together, and are served by the same alternating current supply, synchronous motors may be used to operate both discs. For stations far apart, a separate synchronizing signal may be sent out which controls the speed and phase of the receiving disc.

At present, the images transmitted are confined to single objects or simple scenes. Most discs contain 60 holes, which divide the image into 60×60 or 3600 elements, and rotate at 20 revolutions per sec. Thus, the photo-electric cell, transmitter and receiver must be able to generate, transmit, and recover signals over the frequency range from 20 to 3600×20 or 72,000 cycles per sec., which is all that present equipment is capable of handling. However, the detail of a moving image of 3600 elements is much better than that of a still image of the same number of elements, due to the fact that the eye does not have time to scan each part of the moving picture in detail, as it does a still picture. Future developments will undoubtedly make it possible to increase the detail of the images, so that scenes involving large groups of people can be successfully transmitted.

Television signals are almost entirely confined to the high-frequency range between 2,000 and 80,000 kilocycles, for the range of frequencies required for the transmission of television signals is much greater than is permissible in the already congested broadcast range. Due to atmospheric electric conditions, the images received are not always free from fading and distortion.

Larger images than were obtainable with the flat-electrode neon-lamp are being produced by using new types of gaseous discharge lamps in which the glow is confined to a small area, and is intense so that a greatly enlarged image may be projected onto a translucent screen by a suitable arrangement of lenses and the scanning disc.

Another method of television reception being developed uses a cathode ray tube and electrical scanning, thus doing away with the neon lamp, scanning disc and all rotation machinery. The incoming signals vary the intensity of a beam of cathode rays which determine the brightness of the spot on a fluorescent screen upon which they impinge. Scanning may be effected by passing the rays between two sets of electrostatic deflecting plates, each set being energized by currents of different frequencies, one for horizontal, the other for vertical scanning, or else two sets of coils may be used to deflect the beam in much the same way. Special forms of cathode-ray tubes also show promise for use in producing the signals to be transmitted.

Although television is still in the experimental stage, television in color has been achieved and two-way television stations, allowing sight and conversation between two parties, have been set up. Signals have also been transmitted across the Atlantic.

T. S.

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TELFORD, THOMAS (1757-1834), Scottish engineer, born at Eskdale, Dumfriesshire, Aug. 9, 1757. In 1780 he obtained employment as an engineer at Edinburgh, and two years later had a share in the construction of Somerset House, London. He gained a reputation as a canal constructor, and in 1804 was made chief engineer of the Caladonian Canal. He acted in a similar capacity in the construction of the Gloucester and Berkeley Canal, in 1818, the Grand Trunk Canal, in 1822, and laid nearly 1,000 mi. of roads in the Scottish Highlands and in north Wales. A widely praised project was Telford's construction of the Warsaw-Brest-Litovski road. During 1828-30 he drained 50,000 acres in the Fen country. Telford died at London, Sept. 2, 1834.

TELFORD ROADS. *See* MACADAM ROADS.

TELL, WILLIAM (13 cent.), Swiss patriot, according to popular belief was born in the canton of Uri, in the late 13th century. In 1307, when the Austrian governor ordered all to pay him homage, Tell refused and was compelled to shoot an apple from the head of his son. The patriot struck the apple but was put in chains when he told the authorities that he would have killed the governor had he hurt the child. A storm broke while Tell was being carried across a lake, and the hero was freed in the emergency. Tell, escaping, shot the governor. Rossini based an opera on this story. *See also* WILLIAM TELL.

TELLER, a bank employee who does business with customers over the counter. The term was applied

in early stages of BANKING when the lack of a standardized system necessitated the weighing of MONEY brought to the bank and hence the telling of how much the coins were worth. The amounts were tallied by notches cut in a willow stick which was then split in half, the customer keeping one part and the bank the other. Today the paying and receiving tellers are the most familiar types, though in some banks there are also collection, coupon and note tellers.

TELLURIDE, a class of minerals consisting of one or more metals in chemical combination with the metal tellurium. The tellurides of gold, and of gold and silver, are the only naturally occurring compounds of gold. Though rare, they form valuable gold and silver ORES. The gold and silver tellurides CALAVERITE, PETZITE, and HESSITE are mined in western Australia, where the mercury telluride coloradoite is also found. Siberia and Transylvania also possess telluride deposits. In the United States SYLVANITE, calaverite and PETZITE occur in California, Colorado and Nevada, accompanied by the lead telluride, altaite. See also ORE DEPOSITS.

TELLURIUM, a chemical element belonging to the same group as sulphur, and resembling it in its properties. Its chemical symbol is Te, its atomic weight 127.5, sp. gr. 6.25. In the pure state it has a metallic appearance, is silvery white, very brittle, and melts at 452° C. It was discovered by Klaproth in 1798, and occurs widely distributed in nature, though always in small quantities. Its chief commercial supply are the slimes from copper and lead fineries. There is some use for tellurium in radio equipment, and diethyl chloride has been suggested as an anti-knock compound in gasoline, but so far its nauseating odor has prevented this.

TELUGU (Tenugu or Telinga), the chief DRAVIDIAN language, spoken by over 23,000,000 persons in eastern Hyderabad, the northern half of the Madras Presidency, and part of Mysore. Its chief characteristics, as compared with the kindred TAMIL and Canarese, are a tendency to assimilate neighboring sounds, peculiar pronouns, absence of any distinction of gender (feminine nouns always being considered neuter), etc.

The oldest literary document in Telugu is a metrical inscription of 890, and the first known writer, Nannaya Bhatta, author of a Telugu grammar and of a version of the *Mahābhārata*, lived in the 11th century. The bulk of the literature belongs to the times of the kings of Vijayanagar (16th century). It is much influenced by SANSKRIT models, the only notable exception being presented by Vemana, to whom is attributed a collection of moral sayings which are the most popular work in all Telugu literature. J. B.

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TEMESVÁR. See TIMISOARA.

TEMPE, a town in Maricopa Co., southern Arizona, situated on Salt River. It is 10 mi. southeast of

Phoenix, and is served by the Southern Pacific railroad. The town has flour mills and milk products factories. It is the seat of Tempe State Teachers' College. Tempe was an early Mormon settlement, which early developed irrigation. The Tempe Bridge spans Salt River at this point. Pop. 1920, 1,963; 1930, 2,495.

TEMPELHOF, Berlin-Tempelhof, formerly a southern suburb of BERLIN, since 1920 part of Greater Berlin and the seat of the 13th municipal administrative district. It has advanced educational institutions and active industries, and is also a pleasant residential district. It is the home of the famous Tempelhof airport, one of the world's most important flying fields.

TEMPERA, a process of painting in which the color is bound by egg or size. Egg as a medium has had more extensive use; yolk and white combined, or each used separately, often with the addition of vinegar, wine, milk, honey or the sap from young shoots of fig trees. The size used by the early Egyptians and Babylonians for their wall paintings, mummy cases and papyrus rolls came from fish glue, and shredded parchment which had been boiled down. Tempera is the earliest known and was the most widely used mode of painting, and there is a curious agreement in the technique and formulas for combining media for different surfaces in both East and West. Tempera and early oil practice cannot be separated. It was used on the actual plaster of the Italian tombs and in Italian panel painting from the 4th to the 6th centuries B.C. In the Gothic period tempera painting was largely used in an architectural setting and for parchment manuscripts. Its modern use, now called distemper, for scene painting and mural decoration, goes back to its similar use in the Italian cities of the Renaissance.

TEMPERAMENT, in music, the modification of the scale that came into effect in the 17th century, and since then the standard method of tuning all instruments. The method is a necessary compromise, for pure tuning, called JUST INTONATION, does not result in equalizing all of the 24 major and minor keys in music. For instance, the sum of three major thirds should equal an OCTAVE which is what equal temperament demands, but when they are purely tunes they fall short of that requirement. It was necessary to establish some arbitrary limit so that harmonized music could be held within certain bounds and bring uniformity to the various octaves on instrumental keyboards.

Andreas Werkmeister (1644-1706) and Johann Neidhardt (d. 1740) worked at the problem, and JOHANN SEBASTIAN BACH (1685-1750) became a master tuner, as well as the leading composer of the Classical Age in music. Bach evolved the idea of tuning all the major thirds on the clavichord a trifle sharp. This slight AUGMENTATION gave the correct sounding octave. Further, by slightly diminishing four successive fifths in tuning, the last note was found to form a satisfactory major third with the key-note. While the notes B sharp and C flat are the same on the piano keyboard, their acoustic values are slightly different.

Strictly speaking, C flat is a shade lower than B sharp. The same applies to any black key which may be either the sharpened or flattened tone of the white keys immediately next to it. Pure tuning would give these nice variations in PITCH but would necessitate innumerable additional levers, strings and keys in the piano alone.

T. St.

BIBLIOGRAPHY.—Hermann von Helmholtz, *Sensations of Tone*, 1862; Phillip Spitta, *Life of Bach*, vol. 2, p. 41-42, 1899.

TEMPERAMENT, the characteristic mental and physical make-up of an individual. It is largely a phase of the emotional life. The usual classification of temperaments, derived from the Greeks, is as follows: the choleric, the sanguine, the phlegmatic and the melancholic. These were dependent on the proportion of the four body humors entering into their composition, and were produced by the predominance of yellow bile, blood, phlegm and black bile respectively. Warren and Carmichael have improved on this ancient analysis and have introduced the following scheme which takes into consideration the motor phase and the feeling tone accompanying the several types of temperament:

Motor phase	Feeling tone	Temperament
active	pleasant unpleasant indifferent	sanguine choleric mercurial
passive	pleasant unpleasant indifferent	jovial melancholic phlegmatic

TEMPERATE ZONES, the two temperate or intermediate zones lying on either side of the tropics. Their boundaries are defined by the equatorial latitudes of 23½ N. and S., and the polar circles at 66½ N. and S. Combined, they comprise 52.7% of the area of the earth. In the south temperate zone, the greater part of the surface is water. Its land area consists of one-fourth of South America made up chiefly of Argentina and Chile, regions supporting one-fourth of that continent's people; more than one-half of Australia, containing three-fourths of its people; New Zealand; and 7% of Africa, containing 4% of its population. This land totals 4,000,000 sq. mi. and the ocean area is about 12 times as great. Hence, much of the south temperate zone has a marine climate and in many ways is similar to the tropics.

The temperature of the globe is equalized largely by the influence of the great ocean currents, such as the Gulf Stream and the Japan Current, which form great systems of water circulation. Ocean currents are either warm or cold. Some are known as surface and others as deep-sea currents. Warm surface currents move eastward in each of the great oceans, the Atlantic and the Pacific, modifying profoundly the climate of the western shores of continents, as shown in the mild climate of northwestern Europe and western North America. On the other hand, cold ocean currents cool the waters of the equatorial regions.

A scheme prepared by W. Köppen, a German meteorologist, takes account of all elements which produce differences of climate. In this scheme, he assigns considerable importance to rainfall, which depends largely on prevailing winds.

The north temperate zone is about equally divided between land and water, having approximately 26,000,000 sq. mi. of each. Its continents are broad in the high latitudes and narrow toward the Equator. It includes, in North America, all of the United States proper, part of Mexico, most of Canada and all but the northern part of Alaska. Nearly all of Europe, most of Asia and part of north Africa lie within it. These continents comprise the most highly developed nations of the world economically and culturally, and support the majority of the civilized people.

In these zones variability is the distinguishing feature of the climate as regards temperature, winds and rainfall. This is caused by the great variation in the altitude of the sun at different times of year and the consequent uneven length of day and night and the division into distinct seasons. Also the prevailing western winds are much less regular in direction and velocity than the trade winds of the tropics. The same latitude can have widely different conditions at any given time, depending upon whether it is inland or near the coast. Maximum temperatures in summer are in some places tropical and in winter approach polar cold.

Climate is also affected by cyclones and similar revolving storms caused by low atmospheric pressure in the center. But the consequent centripetal direction of the winds is diverted by the earth's rotation, which forces them in a circular counter-clockwise direction in the Northern Hemisphere and in a reverse direction in the Southern Hemisphere.

The subtropical belt adjacent to the torrid zone is affected alternately by trade winds and westerly winds. The windward coasts, such as those along California south of San Francisco and along the Mediterranean, have a fairly uniform temperature and annual rainy seasons. They are important fruit-growing regions. On the leeward coasts in the southeastern United States and southeastern Asia, the rainfall is heavier, with no pronounced seasons, and there is a greater range in temperature. Here the chief crops are sugar cane, rice and cotton.

In the higher latitudes, the continental areas have extreme ranges in temperature, especially in the interior. In northwestern Canada the difference between the high and low in a year is sometimes 150°, and in northeastern Asia 180°. Some interior regions are shut in by mountain barriers or far removed from the sources of moisture, and become deserts such as the Great Basin of the United States and the Gobi Desert of inner Mongolia. There are also semiarid regions such as the great plains of the United States and the Russian steppes. The humid areas receive moderate rainfall and raise large cereal crops.

TEMPERATURE INSTRUMENTS. See THERMOMETRY; PYROMETERS.

TEMPERATURE SCALE. The most widely used temperature scales are the Fahrenheit and the Centigrade. On the Fahrenheit scale, freezing point of water (at normal atmospheric pressure) is 32°, on the Centigrade it is 0°; boiling point is 212° F. or 100° C. The two scales coincide at -40° either Centigrade or Fahrenheit.

The method of calculating the temperature equivalent in one scale from the known temperature expressed in the other scale may be explained as follows: There are 212 minus 32 or 180 Fahrenheit degrees between freezing point and boiling point. In the same interval there are 100 minus 0 or 100 Centigrade degrees. Thus, 180 Fahrenheit degrees equal 100 Centigrade degrees, or one Fahrenheit degree equals $\frac{100}{180} = \frac{5}{9}$ Centigrade degree. For example, 41° F. is 41° - 32° or 9° F. above freezing point. As one Fahrenheit degree equals $\frac{5}{9}$ Centigrade degree, 9° F. above freezing point represents 5° Centigrade above freezing. Since Centigrade freezing point is at 0°, 9° F. above that point (i.e., 41° F.) represents 5° + 0 or 5° C.

TEMPERATURE CONVERSION TABLE

CENTIGRADE TO FAHRENHEIT

°C	°F	°C	°F	°C	°F
100	212.0	60	140.0	20	68.0
99	210.2	59	138.2	19	66.2
98	208.4	58	136.4	18	64.4
97	206.6	57	134.6	17	62.6
96	204.8	56	132.8	16	60.8
95	203.0	55	131.0	15	59.0
94	201.2	54	129.2	14	57.2
93	199.4	53	127.4	13	55.4
92	197.6	52	125.6	12	53.6
91	195.8	51	123.8	11	51.8
90	194.0	50	122.0	10	50.0
89	192.2	49	120.2	9	48.2
88	190.4	48	118.4	8	46.4
87	188.6	47	116.6	7	44.6
86	186.8	46	114.8	6	42.8
85	185.0	45	113.0	5	41.0
84	183.2	44	111.2	4	39.2
83	181.4	43	109.4	3	37.4
82	179.6	42	107.6	2	35.6
81	177.8	41	105.8	+ 1	33.8
80	176.0	40	104.0	0	32.0
79	174.2	39	102.2	- 1	30.2
78	172.4	38	100.4	- 2	28.4
77	170.6	37	98.6	- 3	26.6
76	168.8	36	96.8	- 4	24.8
75	167.0	35	95.0	- 5	23.0
74	165.2	34	93.2	- 6	21.2
73	163.4	33	91.4	- 7	19.4
72	161.6	32	89.6	- 8	17.6
71	159.8	31	87.8	- 9	15.8
70	158.0	30	86.0	-10	14.0
69	156.2	29	84.2	-11	12.2
68	154.4	28	82.4	-12	10.4
67	152.6	27	80.6	-13	8.6
66	150.8	26	78.8	-14	6.8
65	149.0	25	77.0	-15	5.0
64	147.2	24	75.2	-16	3.2
63	145.4	23	73.4	-17	+1.4
62	143.6	22	71.6	-18	-0.4
61	141.8	21	69.8	-19	-2.2

The results of this reasoning may be expressed briefly in the following formulae which have been used in computing the tabulated equivalents and which may also be used to calculate any other temperatures beyond the range of this tabulation:

$$C = \frac{5}{9}(F - 32) \quad F = \frac{9}{5}C + 32$$

where C is the Centigrade and F the Fahrenheit reading. See also CENTIGRADE TEMPERATURE SCALE; FAHRENHEIT TEMPERATURE SCALE; ABSOLUTE TEMPERATURE SCALE; REAUMUR TEMPERATURE SCALE.

TEMPEST, THE, one of the latest and best plays of SHAKESPEARE; produced about 1611. It was suggested probably by various travel books of the day, especially by Jourdan's *Discovery of the Bermudas*, 1610. The aged Prospero, unlawfully deprived of the dukedom of Milan by his brother Antonio, lives happily on an enchanted island with his daughter, the fair Miranda, and two supernatural servitors, Ariel and Caliban. By magic Prospero one day sinks a ship in a tempest, and causes all the passengers to be safely landed on the island. Then plots and lively counterplots begin, for among the passengers are the usurping Antonio, the villainous courtier, Sebastian, the dotard counselor, Gonzalo, and Ferdinand, the handsome son of the king of Naples. One enchantment is succeeded by another until at last a reconciliation is effected between Prospero and Antonio, and a marriage is promised for Miranda and Ferdinand. Excellent farce is provided by Caliban, Stephano, the butler, and Trinculo, the jester.

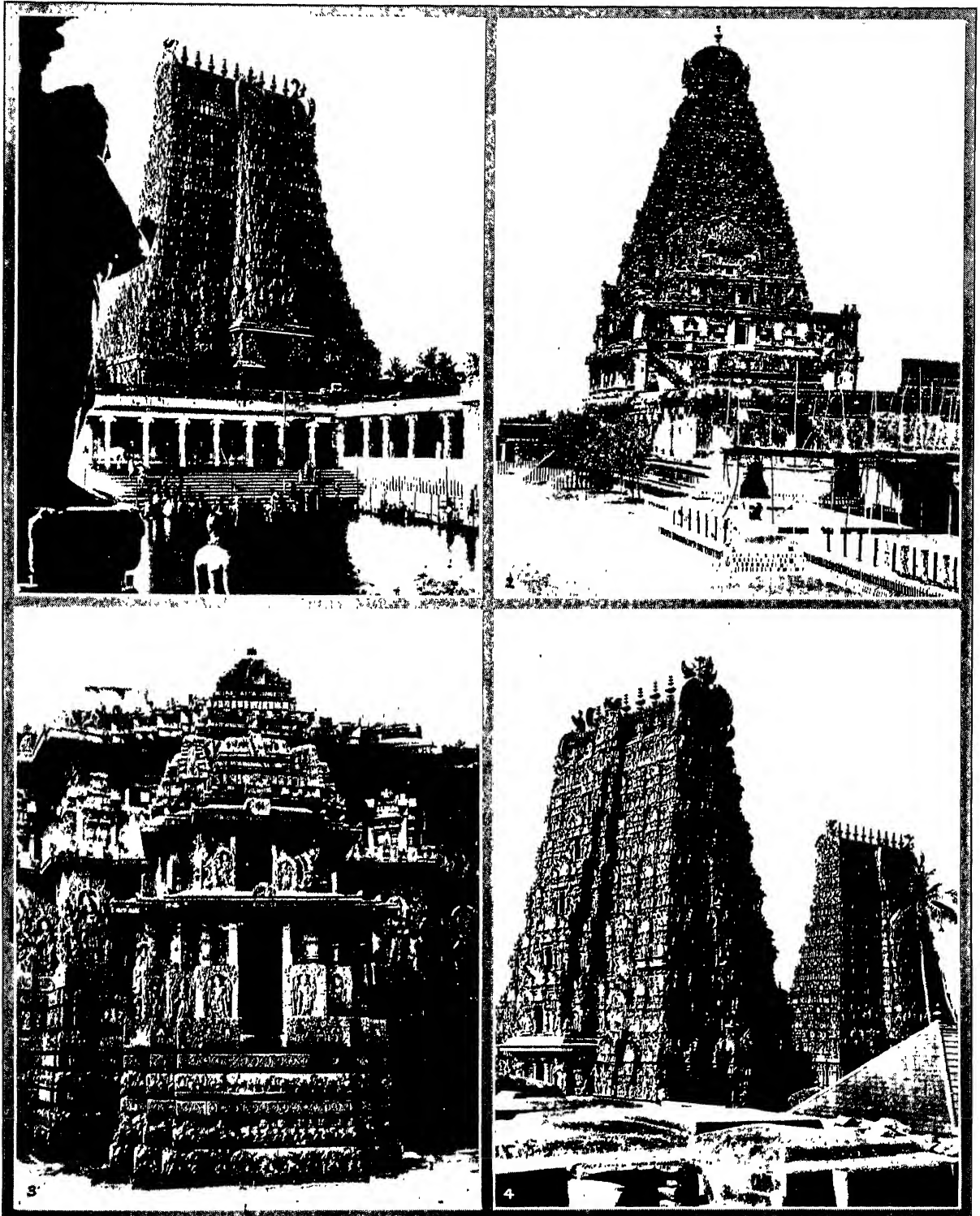
TEMPLAR, KNIGHTS. See KNIGHTS TEMPLAR.

TEMPLE, SIR WILLIAM (1628-99), English diplomat, statesman and author, was born at London, in 1628. He was one of the important figures of his time and his public career extends through the reign of Charles II into that of William III. While not eminent in domestic matters, Temple showed great skill as a diplomat and negotiator, and the uprightness of his character was conspicuous in an age when public life was so manifestly corrupt. His writings were, mainly, political but include essays on many subjects. His best known works are *Memoirs*, an unauthorized edition, 1691-1709, and *Miscellanea*, 1680-92. He was the patron of Swift who was his secretary for 10 years. In 1681 he retired, and spent the remainder of his life writing. He died at Moor Park, Surrey, Jan. 27, 1699.

See E. S. Lyttel, *Sir William Temple*.

TEMPLE, roughly, any building or area set apart for religious rituals; also, in modern times, a building for a fraternal organization. Sometimes the word is specifically applied to synagogues. Temples date from the earliest times in which men developed a social rather than an individual type of religious ritual. The earliest temples seem to have been either caves or mountain tops, the former being related to the deities of the earth and the latter to the deities of the sky. In cultures in which there is a cult of the dead, tomb temples also developed. The requirements of primitive temples consisted of an altar of sacrifice, set in a

TEMPLE



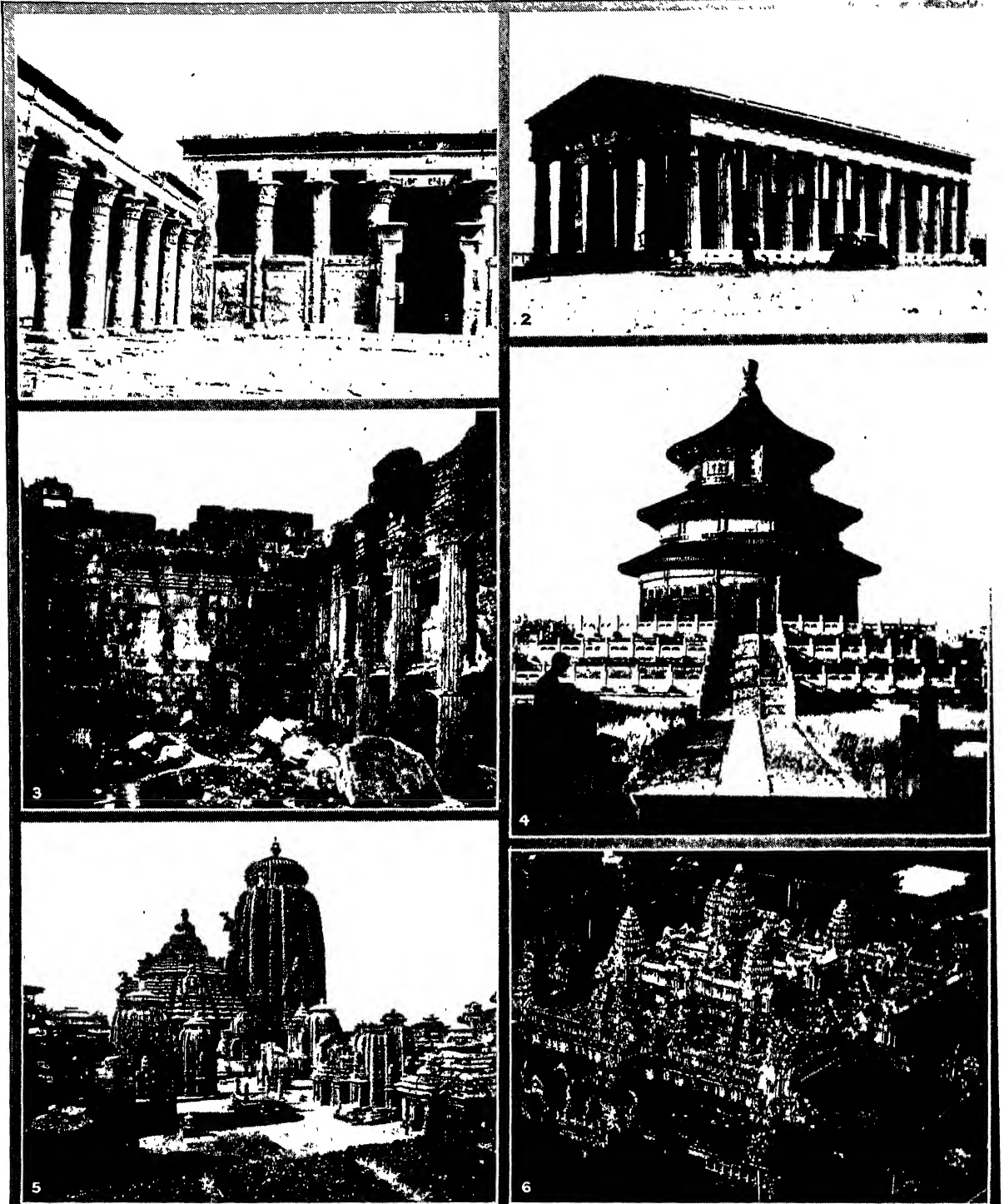
COURTESY INDIA STATE RAILWAYS

GREAT TEMPLES OF INDIA

1. Great Temple of Madurai, showing towering gopuram and Tank of the Golden Lilies. 2. The Great Temple of Tanjore, built about 1000 A.D. 3. Corner of the temple of

Hallabid. 4. Great Temple at Madurai: view of gopurams of temple dedicated to Minakshi, "the fish-eyed goddess." The Great Temple is a Hindu shrine of the 17th century.

TEMPLE



2, 3, EWING GALLOWAY PHOTOS; 4, R. MOULIN, FROM EWING GALLOWAY; 5, COMPAGNIE AERIEUNE FRANÇAISE, FROM R. I. NESMITH AND ASSOCIATES

FAMOUS TEMPLES OF THE EAST AND WEST

1. Peristyle court of the Temple of Edfu, Egypt. 2. Doric-columned hexastyle temple, the Theseum, to the northwest of the Acropolis, Athens. 3. Interior of the cella of the Temple of Jupiter, Baalbek, Syria, with Corinthian columns. 4. The Temple of Heaven, in the "outer," or Chinese City,

Peiping (Peking), China. 5. Great Temple of Bhubaneswar, India, built during 617-57. Every inch of the surface of the Great Tower (in the center), 180 ft. high, is covered with elaborate carving. 6. Temple of Angkor-Wat, Cambodia. 13th century.

reserved space usually enclosed; and this primitive type persisted long in certain parts of the world, notably in Persia, in the simple fire temples, and in China, where the Ming Dynasty Temple of Heaven at Peking has as its main feature a series of circular terraces around a mound, with an altar upon the top. When images and fetishes began to be worshiped, there was also need of some sort of building to enclose them. In certain primitive cultures in the Pacific and elsewhere, the temple which contains the images serves as well for a dwelling place and clubhouse for the warrior men.

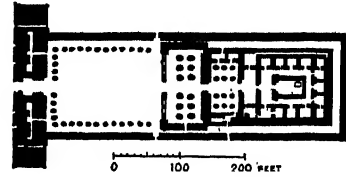
Cave Temples. By Neolithic times, the cave temple had reached a high state of development, as shown by the remarkable cave temples of Malta, especially Hal Tarxien, notable for its altar stones decorated with spirals, the phallic stones set in important positions, and a large number of steatopygous female statues, which seem to indicate that these temples were dedicated to a great mother goddess. The cave temple persisted into much later times, as shown in such examples as the Temples of Rameses II at Abou Simbel in Egypt, the early temple shrines of India, and the large number of groups of Buddhistic cave temples in western China, mostly of the 5th and 6th centuries A.D. The Indian temples have continued in use up to the present day, and are both Buddhist and Hindu.

Hill-Top Temples. The "high places" referred to in the Old Testament are well-known examples of hill temples. In many cultures, such high places were imitated artificially by building mounds or pyramids, faced with brick or stone, and approached by steps or ramps. The pyramid temples of Mexico and Central America, such as those at Chichen Itza, are famous examples, and the Chaldean and Assyrian stepped pyramids or ziggurats are also obviously derived from the same source. In Mesopotamia, the ziggurat proper was usually crowned by a shrine and an altar, and surrounded by an elaborate series of courts and halls for the priests, often with additional altars for popular worship.

Temple Buildings. It was the temple building to enshrine an image or sacred symbol which led to the most important architectural results. The Egyptian temple is a characteristic complex development, based on an elaborate ritual. The type had become standardized by the middle of the 2nd millennium B.C. and held true almost to the Christian Era. It consisted of a large court, usually colonnaded, and fronted by pylons, two great sloping-sided towers, between which the gateway was placed. The side of the court opposite to the entrance was usually occupied entire by a columnar or hypostyle hall, sometimes lighted by clerestory windows. Behind this hall lay smaller chambers, growing increasingly dark, low, and narrow until the final secret shrine, or holy of holies, was reached. Every wall and column surface was covered with carving painted in bright colors and hieroglyph inscriptions; the impressive effect of the gloomy light, the rich colors, and the decreasing size of the rooms as the

entrance was left behind, was tremendous. The best preserved example is the late temple at Edfu, 257-237 B.C.

Various small models exist showing typical Phoenician and Syrian temples, consisting of a flat-roofed



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PLAN OF THE TEMPLE OF EDFU, EGYPT

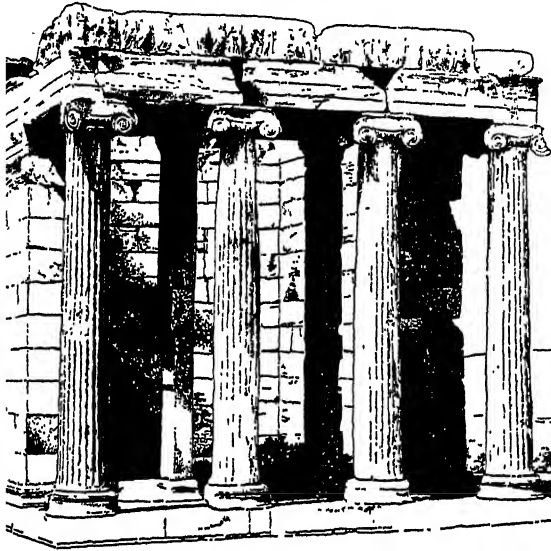
building with twin pillars in front of the door. The same type, at a monumental scale, and incorporating certain Egyptian features, appears in the temple at Jerusalem, built by Solomon and rebuilt by Nehemiah. (I Kings 6:7.) This had a large courtyard, containing a great altar, from which the temple building was entered. The temple front was probably of Egyptian pylon type, and its door was flanked with the typical Syrian free-standing columns, possibly reminiscences of primitive phallic significance. The main temple hall was lighted with lattice windows, perhaps like the clerestory of the temple at Karnak. Behind this was the Holy of Holies, containing the Ark of the Covenant, with gilded cherubim on each side. Much of the ornament described seems of Mesopotamian origin; but the construction, with stone, timber and sheet metal combined, is characteristic of Syria.

Greek and Roman Temples. Typical Aegean shrines seem usually to have consisted simply of an open space, surrounded by a wall and containing an altar and sometimes a small shrine. A distinctive feature was the use of great paired horns on the shrine roofs or the altar top. Recently a large tomb temple, consisting of a two-story shrine over the tombs and fronted by a courtyard with a colonnaded pavilion opposite, has been excavated near Knossos in Crete; it dates from the late Minoan period.

The Dorian invaders of Greece built enclosed and roofed temples, partially based on the Mycenaean house, to enshrine their gods. The early walls were of sun-dried brick, and there was often a row of columns down the center. The roof was a simple gable, and there was frequently a porch in front, set between continuations of the side walls, *in antis*. Later, two rows of columns were used on the interior, and a porch at the rear was added; later still, a separate colonnade was built surrounding the entire building. This is the case in the early temple of Hera at Olympia, originally built with wooden columns, which were replaced with stone as they rotted. By the end of the 7th century B.C., this type had become standardized and was built entirely in cut stone instead of the earlier brick.

The characteristic Greek temple of the Periclean Period and later merely carried these arrangements to

a higher level of refinement. The temple proper had a colonnade around it, forming a porch or *pteroia*. Inside the colonnade were the walls of the enclosed space or *naos* (*cella* in Latin); the primitive porches in *antis* at each end were retained inside the outer colonnade. The *naos* was usually divided into a nave and side aisles by columns, often in two tiers; frequently there was a small room at the rear, called an *opisthodomus*, usually entered from the *naos*, but sometimes from the rear porch. The colonnade usually had six columns at the ends, and 13 or more

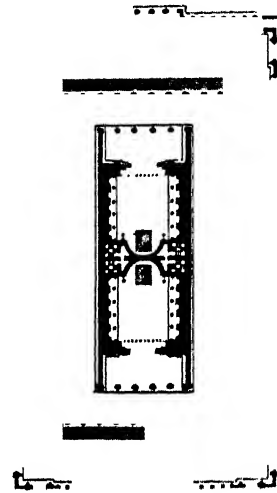


PORTICO WITH IONIC COLUMNS OF THE EAST FAÇADE OF THE TEMPLE OF NIKÉ APTEROS, ATHENS, BUILT ABOUT 426 B.C.

on the sides; the Parthenon, Athens, 447-38 B.C., had eight columns on the front. The entire building glowed with color, blue, red and gold being used freely in the decoration of the marble. The gables or pediments at each end were filled with sculpture; and the cult statues, sometimes of ivory and gold, stood at the inner end of the *cella*, which was also filled and enriched with votive offerings. Many of the Greek temples were surrounded with a *temenos* or sacred area, in which were many minor buildings, such as treasuries, smaller shrines, colonnades, etc. In Asia Minor, temples were usually of the Ionic order, instead of the Doric common further west; frequently they were enormously larger than the Doric examples.

Roman Temples. The typical Roman temple was a blend of Greek forms, with influences from the wide, squat Etruscan temples; thus Roman temples are usually much wider for their length than the Greek, and frequently have a porch merely in front, with the *cella* walls decorated by engaged columns, as in the Maison Carrée at Nîmes, circa 1 A.D. The Roman structural ingenuity in building trusses and vaults enabled the Romans to dispense with the interior columns of the Greek temple, and thus produced more spacious interiors. Interior wall treat-

ments were frequently lavish, with engaged columns and richly framed niches; sometimes there was an apse, or large niche, for the cult statue, at the rear. Roman temples were usually set on a high podium,

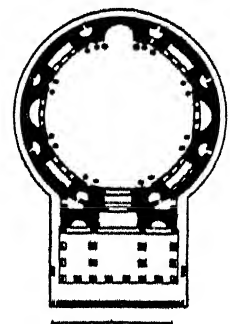


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PLAN OF THE TEMPLE OF VENUS AND ROME AT ROME, ITALY

instead of the low Greek steps, and were approached by a monumental stairway. In addition to the standard rectangular type, many variations are found. Thus at times, as in the Temple of Concord at Rome, 10 A.D., the entrance is in the middle of the long side of the *cella*. Round temples are also common, in which the circular *cella* is surrounded by a circular portico. The largest of the round temples, and one exceptional both in its size (144 ft. internal diameter) and its arrangement, with a rectangular portico in front, is the superb Pantheon at Rome, 110-125.

In connection with the classic temple, numerous technical terms are commonly used. These are partly as follows: *Prostyle*, having a porch at the front. *Amphiprostyle*, having a porch at both ends. *Peripteral*, having a colonnade completely surrounding the *cella*. *Pseudoperipteral*, having a porch only in front of the *cella*, with the outside of the *cella* walls ornamented with pilasters or engaged columns. *In antis*, a term used of columns set between the ends of walls which project to form the sides of a porch, each of the wall ends is an *antia*. *Dipteral*, having a double colonnade at the sides of the *cella*. *Pseudodipteral*, having the columns at the sides



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PLAN OF THE PANTHEON

of the cella far enough from the cella wall to allow an inner row of columns, but with the inner row omitted. *Tetrastyle*, four-columned. *Hexastyle*, six-columned. *Octostyle*, eight-columned, and so on for all the Greek numbers; these terms are usually used to describe the number of columns in the front of a portico or temple.

Indian Temples. In addition to the stupa or tumulus, the early Hindus built highly developed cave temples, both for Buddhist and Brahman use. These temples have high, curved topped interiors, with nave and aisles separated by richly carved piers; at the end is usually a small stupa. Other cave temples have, in addition to the shrine, courtyards surrounded by cells for monks. The architectural details shown in these rock-cut temples, from the 2nd century B.C. to the 7th century A.D., are obviously based on a primitive wooden construction. Rich figure sculpture is common. In the later periods and in the flat portions of India, elaborately constructed temples are the rule, both under Dravidian and Jaina influence. The scheme usually consists of one or more enclosed courts entered by monumental gateways, crowned with rich towers; near the center is the shrine proper, often tower crowned, and sometimes approached by colonnaded halls. Particularly from the 16th century on, every exposed surface is intricately carved with bands of rich moldings and high relief figure sculpture. Columns and piers are often decorated with elephants or horses.

Hindu influence dominates the temple buildings of Cambodia, Burma, and the islands off the Malay Peninsula. The stupa type is characteristic of many Buddhist shrines; frequently, as in Rangoon, many small stupas surround one large central stupa. At Borobudur, in Java, the stupas are set on the highest of a series of terraces, whose walls are completely covered with lavish sculpture. In the famous Khmer temples of Cambodia, such as Angkor Wat, there is a new and magnificent monumentality of plan, a characteristic use of extended colonnades, and lavish sculpture, in which the Khmer genius found its highest expression. See INDIAN ARCHITECTURE.

The Far East. Although the Chinese developed many interesting variations of the Indian stupa in connection with Buddhist temples, the most characteristic features of all Chinese temples, whether Buddhist, Confucian, or Taoist, are similar and purely native. The essence of the design is monumental symmetry, and the placing of the main halls with their long sides opposite the entrance and across the main axis. The buildings are arranged around one or more courts; the monumental entrance usually contains the statues of four guardian spirits, and in the first court there are usually two small towers, one on each side, one containing a huge drum and the other a great bell. In the temple halls, a long altar occupies the wall opposite the entrance, and on it stand three statues; in Confucian temples, a rich shrine containing merely the name of Confucius replaces the statues. Minor shrines are often placed in smaller courts, and

the sides of the courts occupied with rooms for priests. In many temples there is one gallery with statues of the 500 Holy Men, or Lohans. In general, the temples of the north are simpler, larger, and more monumental than those of the south.

The Buddhist temples of Japan have temple halls based almost entirely on Chinese precedent, with, however, many variations of detail. They are usually not arranged in the formal Chinese manner, but set as parts of a picturesque composition, often of great subtlety, in which the natural surroundings of the site, etc., are important. The temple grounds are enriched with many stone votive lanterns, sometimes forming avenues, and trees are carefully planted and trained to make perfect pictures with the buildings. Shinto temples are supposed to be built in accordance with an ancient tradition of wooden house buildings, purely Japanese. They are small, since they are compelled by the ritual to be destroyed and rebuilt periodically. A universal characteristic is thatched roofs, and the existence of those lovely and simple monumental gates known as TORII.

See EGYPTIAN ARCHITECTURE; GREEK ARCHITECTURE; ROMAN ARCHITECTURE; INDIAN ARCHITECTURE; CHINESE AND JAPANESE ARCHITECTURE. T. F. H.

TEMPLE, the holy SANCTUARY of the Jewish people, in Biblical and early post-Biblical days up to 70 A.D., and the center of the Jewish religion and of the Jewish worship of God. The term temple is applied to the entire building, including all its separate parts. Its seat was in Jerusalem, the Holy City. Here the priests and Levites carried on their functions, the people worshiped and brought their sacrifices, and here centered the entire religious life of the Hebrew (later, the Jewish) people, until prayer took the place of sacrifice, the priests and Levites were displaced by the rabbis and the teachers of the Law, and the one Temple at Jerusalem, which had originally taken the place of the various local shrines and sanctuaries (see SANCTUARY) of the land of Canaan, itself was replaced by synagogues and houses of study first in all parts of Palestine and Babylonia, and eventually in practically all the countries of the world.

In the course of Jewish history there were three temples at Jerusalem. The first, built by King Solomon from about 973-966 B.C., was for this reason called the Temple of Solomon, or the Solomonic Temple. It was a magnificent and costly structure, and replaced the movable Tabernacle which the Israelites had carried with them throughout the 40 years of their wilderness wanderings and through all the years of the conquest of Canaan under Joshua and the Judges, and the reigns of Saul and David. The description of this Temple of Solomon is found in I Kings 6; its conception and dedication are narrated in I Kings 5 and 8. The First Temple, or Temple of Solomon, was destroyed on the Ninth of Ab, the fifth month of the Jewish calendar, in 586 B.C. by Nebuchadnezzar, King of Babylonia. (II Kings 25; II Chronicles 36).

The second Temple was constructed after the

Babylonian Exile, during the reign of King Darius, of Persia, from about 520-516 B.C. by a handful of Jews who returned to Palestine. It was decidedly inferior to the First Temple in size, appointments and magnificence, and was never completed. It is mentioned several times in the Book of Ezra (Ezra 3:8-13; 4-6); it is sometimes called the Temple of Zerubbabel, for Zerubbabel was the governor of the land during that period. Antiochus IV (Epiphanes) of Syria despoiled and desecrated this Temple in 168 B.C. and thereby precipitated the Maccabean wars; it was purged and rededicated by the Maccabees and their followers in 165 B.C., but was demolished by Herod about 20 B.C. in order to make room for his own Temple.

The third Temple was erected by King Herod, of Judea, in 20-19 B.C. It is usually called the Second Temple, or the Temple of Herod, and was a magnificent and beautiful building, far larger and more imposing than the Temple of Solomon; indeed, it was conceived on such a grand and elaborate scale that it was never actually completed. This Temple and its sacrificial service are described in the works of Josephus and in the tractates Middoth, Tamid, Yoma, Sukkah and Menahoth of the Mishna. The Temple of Herod, or Second Temple, was destroyed by the soldiers of Titus, general of the Roman army, in 70 A.D. According to tradition, this second destruction took place on the Ninth of Ab, the same day whereon the Temple of Solomon had been destroyed more than six centuries previously.

No other temple ever took the place of the Temple of Herod in Jewish history; instead, synagogues and houses of prayer and study were from this time forth erected in the various cities wherein Jews came to dwell, and the sacrificial cult and the service of the priests and Levites ceased for all time. The attempts of the Emperor Hadrian, about 120, and the nobly conceived and sincere attempts of the Emperor Julian the Apostate, in 363, to restore the Temple were both abortive. No subsequent attempts were ever made. Nothing at all remains of the Temple of Herod to-day; the so-called Western Wall or Wailing Wall in Jerusalem, where even to-day Jews gather to bewail the loss of the ancient Temple and the departed glories of the Jewish people, is not a part of the ruins of the Temple itself, but merely of the wall which surrounded the Temple Mount. A. SH.

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TEMPLE, a city in Bell Co. in eastern Texas near the Leon and Little rivers, situated 36 mi. south of Waco. There is an airport. Cotton and grain are raised in the vicinity. The city is an industrial center, manufacturing flour and furniture and ginning and baling cotton. In 1929 the value of the factory output was valued at \$3,000,000; the retail trade amounted to \$9,293,933. The city was founded about 1881 by B. M. Temple for the Gulf, Colorado and Santa Fé Railroad, and was incorporated in 1884. Pop. 1920, 11,033; 1930, 15,345.

TEMPLE UNIVERSITY, at Philadelphia, Pa., a privately controlled, non-sectarian institution for men and women, founded in 1884. The name was changed to Temple University in 1907. It comprises schools of Theology, Law, Medicine, Pharmacy, and Dentistry, and operates under a state appropriation. The grounds and buildings were valued in 1931 at \$6,225,594. The library contained 52,000 volumes. In 1931-32 there was a student enrollment of 12,000, and a faculty of 750 headed by Pres. Charles E. Beury.

TEMPO, in music, an Italian term meaning, literally, time, and used often in music with reference both to meter and to velocity. The former is indicated by the time SIGNATURE placed at the beginning of a composition; the latter is indicated approximately by a number of Italian terms forming the vocabulary of musical EXPRESSION, and exactly by means of the METRONOME. For the history of the metrical aspect of music see NOTATION.

TEMUCO, a city of southern Chile, capital of the province of Cautín, situated about 140 mi. southeast of Concepción, on the River Imperial, or Cautín. It has railroad connections with Concepción and Valdivia, and its chief industry is the manufacture of beer and wines. It is an agricultural center for wheat and potatoes. The surrounding district is inhabited by Araucanian Indians, who market their farm products in Temuco. The climate is very rainy; there is an average of 143 days of rain per year with but 59 clear days. Pop. 1930, 35,748.

TENAFLY, a rapidly growing borough of Bergen Co., N.J., located 5 mi. north of the New Jersey terminus of the George Washington Memorial Bridge and adjoining Englewood, N.J., on the north. It is served by the Erie Railroad, electric trolleys and motor bus lines. It is mainly a residential community, being a popular suburb for New York business men, but has several local industries including the manufacturing of dresses, wash cloths and cement blocks. Pop. 1920, 3,585; 1930, 5,669.

TENANKUTCHIN, a tribe of the North American Indian Athapaskan linguistic stock whose hunting-grounds and villages occupy the valley of the Tanana River, Alaska, the various groups trading down the river at Nuklukayet or at Fort Yukon. They are nomadic hunters, securing deer, moose and caribou by impounding and snaring. They live in temporary structures and wear skin clothing trimmed with beads and feathers. Transportation is in birch-bark canoes. Their social organization is simple, the functioning division being the band. They are said to be warlike. In 1931 only a few hundred survived.

TENANTS. Land may be owned by joint tenancy or by tenancy in common. The chief characteristic of joint tenancy is that the property finally descends to the heirs of the last survivor. It is possible, however, for such tenants during life to partition their interests. Whereas, in joint tenancy, the owners are regarded as a unit, in the case of *tenancies in common* the owners have distinct interests and there is no

survivorship. Each owner owns an undivided share. Tenancies in common are now favored over joint tenancies. *See also* LANDLORD AND TENANT.

TENCH (*Tinca Vulgaris*), a small fish of the carp family (*Cyprinidae*) living in the sluggish waters and shallow ponds of Europe, northern Russia, and Asia Minor. Its scaly body, from 12 to 18 in. long, is greenish brown and weighs about 5 lbs. Where other fish are scarce, the tench is sometimes eaten but its flesh is tasteless and soft.

TEN COMMANDMENTS. *See* DECALOGUE.

TENDRIL, a slender organ sensitive to contact and functioning as a support in climbing plants. Twining of a tendril about an object which it touches is caused by a difference in growth-rate between the convex and concave sides of the curved organ; later the free base often coils in the reverse direction and the whole becomes thickened and indurated, adding to its strength. Morphologically tendrils are diverse in their structure and homologies. In the grape they are modified stems; in smilax the stipules function as tendrils; in clematis the petiole twines; in pea the terminal leaflet is a tendril, and in *Flagellaria* the tip of the elongate leaf serves the same function.

TENEBRAE (a Latin word, meaning darkness), the Matins of Maundy Thursday, Good Friday and Holy Saturday, sung in each case in anticipation the evening before. At the singing of the first verse of each psalm or canticle, one of the 15 candles on the Tenebrae-herse is put out. While the canticle *Benedictus* is being sung, all the candles on the Tenebrae-herse being already extinguished, except the one at the summit of the herse, the six candles on the altar are put out one by one, the last at the last verse, together with all the lights in the church. When the antiphon "Now he that betrayed him" is repeated, the lighted candle is taken from the herse and hidden behind the altar at the side of the epistle. After the Misserere and the final collect are sung, a harsh noise, which indicates that of the Jews when they sought Jesus in the garden is made. Then the lighted candle is brought forth and all rise and depart in silence.

TENEMENTS. *See* APARTMENT HOUSES.

TENERIFFE, PEAK OF, a quiescent volcano occupying nearly two-thirds of Teneriffe Island, the largest of the Canary Islands. The highest spur is 12,200 ft. above sea-level and is visible at a distance of more than 100 mi. Forests and meadows cover the lower slopes, but the loftier portions are desolate and devoid of herbage.

TENIERS, the surname of two famous Flemish painters, David, the elder (1582-1649), and David, the younger (1610-90). Teniers the Elder was born at Antwerp in 1582, and studied under his brother Juliaen, RUBENS and Elsheimer. He is chiefly famous for his peasant and tavern scenes. Among his best known works may be included *Playing at Bowls*, *Dutch Kirmess*, *Rocky Landscape* and *Conversation*. The artist died at Antwerp, July 29, 1649.

Teniers the Younger was born in Antwerp and baptized Dec. 15, 1610. He studied under his father

and was influenced by Rubens and Brouwer. In 1632 he became master of the Antwerp Guild, and was later made court painter to Archduke Leopold William, governor of the Netherlands. In 1663 Teniers was the principal founder of the Antwerp Academy. He received many commissions for portraits, and genre and landscape pictures, far surpassing his father in practically every aspect of his art. Among his works which place him as one of the foremost Flemish painters are *The Money-Changers*, *The Music Party*, *Boors Regaling*, *Peasants' Frolic*, *Village Festival*, *Archers* and *The Five Senses*. Teniers died at Perck, near Brussels, Apr. 25, 1690.

TENNESSEE, one of the South Central States of the United States, popularly called the "Volunteer State." It is situated between 35° and 36° 40' N. lat. and 81° 37' and 90° 28' W. long. On the north it is bounded by Kentucky and Virginia, on the east by North Carolina, on the south by Georgia, Alabama and Mississippi, and on the west by Arkansas and Missouri from which it is separated by the Mississippi River. Tennessee comprises an area of 42,022 sq. mi., inclusive of 335 sq. mi.

of water surface, with a maximum length of 432 mi. from east to west and a maximum breadth of 109 mi. from north to south. In size Tennessee ranks thirty-fourth among the states of the Union.

Surface Features. Tennessee slopes from the heights of the Blue Ridge Mountains at the east to the lowlands of the Mississippi valley at the west. Its mean elevation above sea level is 900 ft. and its relief varies from 6,642 ft. on Clingmans Dome in Sevier Co. to 182 ft., the level of the Mississippi in Shelby Co.

The slanting eastern boundary is defined by the Great Smoky range of the Blue Ridge, immediately west of which is the Great Appalachian valley known locally as the Tennessee valley and traversed by the Tennessee River. Rising from the valley floor is a series of low, parallel ridges known as the Cumberland Mountains. They include Holston ridge and Walden ridge, the latter forming the east-facing escarpment of the Cumberland plateau.

This plateau declines gradually westward and gives way in central Tennessee to the Nashville basin, an area similar to the Blue Grass section of Kentucky. The district west of the Tennessee River is the northern extension of the Gulf coastal plain and is a practically flat agricultural region terminating with the bluffs which overlook the Mississippi River.

Aside from several small streams which empty directly into the Mississippi, the principal rivers are the Tennessee and Cumberland which empty into the Ohio. Reelfoot Lake in Obion Co. is famous as a hunting ground for wild fowl.



TENNESSEE STATE SEAL

Climate. Except in the more elevated mountain districts, the climate of Tennessee is even and pleasant. The mean annual temperature is 58.5° F. and except in the eastern part shows very little variation throughout the year. At Nashville the average for January is 38.6° F. and for July, 79.1° F. During the period 1884-1930 the highest temperature recorded in Tennessee was 113° F. and the lowest, -32° F. The average annual precipitation is 50 in., including 9.7 in. of snow. Except in the eastern highlands there is a growing season of about six months.

Forests and Parks. In a natural tree growing region, Tennessee originally had extensive forests. Timber stands, in the 1931 estimate, cover 13,304,000 acres or approximately $\frac{1}{2}$ the land area of the state. Three sections, western, middle, and eastern, may be distinguished. The western section contains rich alluvial lands producing heavy stands of oak, cottonwood, red gum, hickory and some cypress. The middle region has been almost entirely cut over and devoted to agriculture. Remaining woodlots contain chiefly oak with some other hardwoods such as poplar, chestnut, ash, cottonwood and hickory. Due to differences in elevation a great variety of species is found in the eastern division. On the high ridges, balsam and spruce predominate and at lower elevations are oaks, gum, beech, basswood, black walnut, hickory, yellow pine and black locust; also some sassafras, sycamore, elm and black birch. The heaviest growth and greatest variety is found in protected valleys. Interest in reforestation is keen but as yet Tennessee has no state forests. Sections of the Cherokee, Pisgah and Unaka national forests totaling 376,857 acres in 1930 extend into the eastern part of the state. Fort Donelson, Shiloh and Chickamauga and Chattanooga national parks administered by the War Department, and MERIWETHER LEWIS National Monument are located in Tennessee.

Minerals and Mining. Tennessee possesses extensive and varied mineral resources, the chief of which are bituminous coal fields mainly in the central counties and widely distributed deposits of building stone. Important also are the large beds of excellent clays in the western districts and of phosphate rock in the central and southern sections. There are valuable ore deposits, notably of zinc in the eastern counties and of copper, bearing small quantities of silver and gold, in the extreme southeast.

With mineral productions in 1929 amounting to \$40,719,706, Tennessee stood twenty-fourth among the states, ranking first in marble and pyrites, second in phosphate rock, and third in barite. It also stood sixth in quantity of lime and tenth in quantity of coal produced.

The principal products in order of value were coal, 5,405,464 tons, \$9,122,000; stone, 2,419,070 tons, \$8,043,006, including marble, \$2,287,938, and limestone, \$1,736,472; cement, 4,537,601 bbls., \$5,576,235; copper and zinc, \$4,450,523; clay products, \$3,695,837; phosphate rock, 633,939 tons, \$3,097,104; sand and gravel, \$2,136,524; and lime, 172,936 tons, \$1,036,405.

During 1929 189 mines and quarries gave employment to 12,848 persons who received \$12,853,665 in salaries and wages.

Soil. Alluvial deposits on the Mississippi flood plain and along the bottom lands of other rivers, constitute the most fertile soils in the state. On the bluffs overlooking the Mississippi River a brown loam occurs and also the rich siliceous formation known as loess. The soil of the central and eastern parts of Tennessee owes its fertility to the presence of limestone formation. The outer part of the highland rim also contains limestone soils, but the inner portion is made up of unproductive sandy soils. In general throughout the state the land varies with the difference in the composition of the underlying rocks. The Cumberland plateau and the Appalachian region are generally thin and arid. In both the soils are usually too poor for cultivation.

Agriculture. The chief agricultural productions are corn, cotton, hay, vegetables, and tobacco.

In 1930 18,003,241 ac. or 67.5% of the entire land area was in farms, 245,657 in number, with an average size per farm of 73.3 ac. and an average value per acre of \$41.28. Of the farm area 7,665,776 ac. or 43% was crop land; 5,167,597 ac. or 29%, pasture land; and 3,884,938 ac. or 22%, woodland. The total value of farm property was \$893,842,483, of which \$743,222,363 was represented by land and buildings; \$45,758,093, by implements and machinery; and \$104,862,027, by domestic animals.

According to the census of 1930 Tennessee produced in 1929 field crops to the value of \$187,787,010, ranking twentieth among the states. It stood fourth in tobacco, tenth in cotton and cottonseed and eleventh in corn; in minor crops it ranked fourth in strawberries, fifth in sweet potatoes, eighth in peaches and tomatoes and ninth in beans. The chief crops were grains, valued at \$62,239,203, including corn, 61,045,986 bu. grown on 2,693,141 ac., and wheat, 2,480,846 bu. grown on 279,885 ac. Cotton, 503,816 bales grown on 1,045,051 ac., was valued at \$41,564,820, and cottonseed, 240,613 tons, \$6,977,777. Other important crops were vegetables, \$24,667,611; hay and forage, 1,298,808 tons, \$23,828,158, chiefly timothy, clover and annual legumes; tobacco, 112,236,961 lbs. produced from 129,973 ac., valued at \$20,876,075, and fruits, \$5,238,594. Among the vegetables were sweet potatoes \$5,223,544, potatoes \$4,225,487, tomatoes \$2,399,626, and beans \$650,389. The leading fruit crops were peaches 1,325,109 bu., apples 1,297,199 bu., and strawberries 21,346,626 qts.

Farm products sold by cooperative marketing rose from \$607,671 in 1919 to \$1,381,835 in 1929. Farm machinery and equipment in 1930 included 89,032 automobiles, 9,039 motor trucks, 6,865 tractors, 1,603 electric motors, 4,895 stationary gas engines.

Animal Industry. Cattle-raising, largely for milk production and mule-raising, in which Tennessee stands sixth among the states, is the chief livestock interest. According to the census of 1930 the state ranked twenty-first in total value, \$104,862,027, of

domestic animals on farms. Among these were 1,073,899 cattle reported from 191,274 farms or 78% of all farms in the state and valued at \$42,906,619; mules, 318,567 in number valued at \$28,691,991; horses, 175,375, \$11,362,127; swine, 1,002,319, \$10,083,697; sheep, 625,888, \$4,009,883; asses and burros, 3,528, \$178,322, and goats, 66,770, \$141,225.

Of the cows on farms, 493,209 were kept mainly for milk production and 59,608 mainly for beef production. In 1929, 181,789,691 gals. of milk were produced; the total value of dairy products sold was \$17,689,062. The value of all poultry raised, chiefly chickens, was \$12,158,828; the chickens sold were valued at \$5,161,471. Of 57,319,801 doz. chicken eggs produced, valued at \$15,908,779, 37,969,664 doz., with a value of \$10,554,708, were marketed. The wool clip, 1,299,247 lbs., was valued at \$482,905. Honey, amounting to 1,027,610 lbs. valued at \$236,113, was produced from 123,329 hives.

Fisheries. There is little commercial fishing in Tennessee, the total catch for 1930 amounting to 13,132,000 lbs., valued at \$320,000, all of it taken from the Mississippi River. Mussel shells, carp, buffalo fish, catfish, crappie and sunfish were the most important species taken. The U.S. Bureau of Fisheries distributed 130,650 rainbow trout, 100,000 bass and 28,000 other game fish in state waters during 1930.

Transportation. The Mississippi River is an important transportation artery, establishing communication, via New Orleans, with a world-wide market. Tennessee's principal port on the river is Memphis. The Tennessee and Cumberland rivers are also navigable for light-draught boats. Owing to the broken topography of the eastern part of the state, some portions do not receive satisfactory railroad service. However, in 1930 the aggregate steam railway mileage was 3,962, with the Nashville, Chattanooga and St. Louis, the Louisville and Nashville, the Southern, the Tennessee Central and the Illinois Central the most important lines.

The state's highway system shows constant improvement and extension. On Jan. 1, 1930, there were



TENNESSEE STATE ROADS

82,819 mi. of highways, including 15,184 mi. of surfaced roads and 5,006 mi. of improved state highways. During 1929, highway expenditures were \$38,184,006, of which \$27,740,999 was paid by the state and \$10,443,007 by county and local governments. Gasoline consumption in 1930 aggregated 215,244,000 gals. The state gasoline tax that year produced an income of \$10,719,195 as against \$3,852,524 in 1926. Motor vehicle registrations in 1930 were 368,259 compared with 244,626 in 1925. The rapid growth of trans-

portation by truck is indicated by truck registrations, which rose from 22,914 in 1925 to 37,823 in 1930, or about 70%. During the same period the number of buses in operation almost doubled, increasing from 595 to 1,119.

Manufactures. The manufacturing industries of Tennessee, which almost doubled the value of their output from 1921 to 1929, are based chiefly on the state's agricultural and forest resources.

According to the Census of 1930 Tennessee with manufactures for 1929 valued at \$730,508,612 stood twenty-first among the states, ranking fifth in knit goods and feeds for animals, seventh in cottonseed oil, and tenth in planing mill products. Its 2,855 establishments gave employment to 13,620 officers and employees, who received \$33,203,137 in salaries, and to 128,400 wage earners, who were paid \$115,877,077 in wages. These factories used a total of 606,704 horse power, expended \$16,808,050 for fuel and power, and \$390,802,500 for materials and supplies, and added by the process of manufacture \$322,898,062 to the value of their output.

In this output there were 88 separately enumerated manufactures. Among the principal products with their value were knit goods, \$48,406,388; lumber, \$32,604,611; flour, \$28,600,464; cooking oils, \$26,568,489; cotton goods, \$26,173,993; printing and publishing, \$25,413,231; rayon, \$25,188,075; feeds for animals, \$24,681,882; planing mill products, \$19,487,762; chemicals, \$18,819,789; cottonseed oil, \$18,503,558; tobacco, \$16,871,822, and packed meats, \$16,873,193.

The leading manufacturing cities with value of output were Memphis, \$161,323,679; Nashville, \$108,939,314, and Chattanooga, \$103,017,490.

Commerce. According to the census of 1930, there were in 1929 2,262 wholesaling establishments in Tennessee, with total sales of \$1,076,015,715. These organizations gave full-time employment to 22,619 men and women whose annual salaries and wages aggregated \$35,134,492. The chief wholesaling center is Memphis, with Nashville, Chattanooga and Knoxville also important.

The total sales of the 23,498 retail stores amounted to \$649,857,182. Sales per store averaged \$27,656; sales per capita were \$248.36.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
General Mdse.	6,113	\$171,155,504	26.35
Automotive	3,058	125,432,259	19.30
Food	6,621	124,298,009	19.12
Apparel	990	43,482,895	6.71
Lumber & Bldg.	652	39,502,565	6.08
Furn. & Household ..	637	32,687,215	5.05
All other stores.....	5,427	113,298,735	17.39

Total, all stores ... 23,498 \$649,857,182 100.00

The city of Memphis handled water-borne commerce on the Mississippi River amounting to 977,100 tons with a value of \$62,846,785. Lumber, iron, coal, sugar and cotton were the largest items.

Finance and Banking. The assessed value of all taxable property in 1929 was \$1,745,245,238. The

total state debt in 1930 was \$81,428,000, most of which was represented by highway notes. Total state revenues in 1928 were \$30,425,319; total disbursements, \$36,081,264. The principal sources of revenue were property taxes, \$4,712,000, and licenses, \$14,348,800. This item included taxes on corporations, insurance companies, motor vehicles and gasoline, \$4,733,074. The principal payments were for highways, \$19,605,820, educational aid, \$5,437,255 and debt service, \$1,012,938.

There were 490 banks in Tennessee in 1930. Of these, 96 were national banks, 393 were trust companies and state banks, and 1 a private bank. Their total capitalization was \$41,356,928; their surplus and undivided profits, \$42,143,000. Total resources were \$579,324,000, with loans and discounts aggregating \$353,764,100. Demand and time deposits totaled \$408,261,000. Per capita demand and time deposits were \$156.06; per capita savings deposits, \$69.80. The total savings of \$182,596,000 were owned by 350,774 depositors. National bank circulation aggregated \$15,873,000.

Government. The legislative body of Tennessee, known as the General Assembly, consists of a Senate composed of 33 members and a House of Representatives of 99 members, all elected for terms of two years. They meet in biennial sessions limited in duration to 75 days. The chief executive is the governor, elected for terms of two years at a salary of \$4,000 per year. The General Assembly appoints the secretary of state for a four-year term. Judicial power is vested in a supreme court, a circuit court, chancery and inferior courts. The supreme court consists of five judges elected for terms of eight years at salaries of \$5,000 per year.

Social Welfare Institutions. In Tennessee such institutions are under the control of the Commissioner of Institutions. The school for the deaf is at Knoxville and for the blind at Nashville, a vocational school for white girls is at Tullahoma and for colored girls at Nashville. There is a training and agricultural school for boys and an industrial school at Nashville. A home and training school for feeble-minded is maintained at Donelson. Hospitals for the insane are at Knoxville, Nashville and Bolivar. A Confederate veterans home is located at Hermitage, near Nashville. At Petros there is a penitentiary and at Nashville a prison.

Education. The first school was founded at Salem about 1780, when Tennessee was a part of North Carolina. Five years later a school was endowed by the legislature of North Carolina. It opened the following year as Davidson Academy, which later became Nashville University. Elementary schools did not reach a proper status until 1830. Separate schools are maintained for Negroes. Children from 8 to 14 years are required to attend school 80 consecutive days annually. In 1928 there were 7,047 public elementary and secondary schools, with 676,421 enrolled pupils and 17,448 teachers.

The number of persons from 5 to 20 years of age

attending school in 1930 was 590,266, or 64.4% of the population within the ages specified, as compared with 523,700, or 62.2%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 145,460, or 7.2%, as compared with 182,629, or 10.3%, in 1920. Negro illiterates numbered 57,251, or 14.9%, in 1930, and 79,532, or 22.4%, in 1920. Native white illiterates numbered 87,406, or 5.4%, in 1930; and 101,809, or 7.3%, in 1920.

For higher learning the state maintains the University of Tennessee at Knoxville, the Polytechnic Institute at Cookeville, the Agricultural and Industrial Normal College for Negroes at Nashville, and teachers' colleges at Johnson City, Murfreesboro, Nashville and Memphis. Prominent other educational institutions are Vanderbilt University at Nashville, University of the South at Sewanee, University of Chattanooga, Union University at Jackson, Cumberland University at Lebanon, and, for Negroes, Fisk University at Nashville, Lane College at Jackson and Knoxville College at Knoxville.

Population. In 1930 Tennessee ranked sixteenth among the states with a population of 2,616,556 or an average of 62.8 per sq. mi., an increase of 278,671 or 11.9% over 1920. The population rose from 35,691 in 1790 to 1,002,717 in 1850, 2,020,616 in 1900, 2,184,789 in 1910, and 2,337,885 in 1920. In 1930 there were 2,138,619 or 81.7% whites and 477,646 or 18.3% Negroes, an increase of 13.3% whites and 5.4% Negroes since 1920. Of the whites 2,125,553 were native-born and 13,066 were foreign-born. The rural population was 1,720,018 or 65.7% of the total, a decrease of 6,641 or 0.4% since 1920; the urban population was 896,538 or 34.3% of the total, an increase of 285,312 or 46.7% since 1920. In 1930 the five largest cities were Memphis, 253,143; Nashville, 153,866; Chattanooga, 119,798; Knoxville, 105,802; Johnson City, 25,080.

Occupations. In 1930 958,386 persons, or 36.6% of the population, were gainful workers 10 years old or older; 79.6% of these were males and 20.4% were females; 76% were native white, 0.7% foreign-born white, and 23.2% Negro. Among the chief occupations, with number of workers, were farmers, 234,445, and farm wage workers, 68,867; factory operatives, 29,818 men and 23,201 women; factory laborers, 45,787; servants, 6,330 men and 38,397 women; salespersons, 20,495 men and 7,557 women; retail dealers, 26,388; clerks, 17,694 men and 8,053 women; school teachers, 3,964 men and 14,984 women; laundresses, 17,832; carpenters, 15,862, and chauffeurs, 14,705.

HISTORY

De Soto in 1541 reached the Mississippi at Memphis; nearby on the Mississippi MARQUETTE camped in 1673, and here LA SALLE built Ft. Prudhomme in 1682. The French Ft. Assumption, built at Memphis in 1714, did not, after the manner of English frontier forts, promote a civilian settlement. French *coureurs de bois* and Carolina fur traders became ac-



1, 2, 4, COURTESY CHAMBER OF COMMERCE, MEMPHIS.

MEMPHIS AND CHATTANOOGA, LEADING CITIES OF TENNESSEE

1. Aerial view of Memphis harbor, on the Mississippi River.
2. Monument to General Nathan Bedford Forrest, a Civil War cavalry leader, in Forrest Park, Memphis.
3. Hydroelectric plant at Hale's Bar on the Tennessee River near Chattanooga.
4. Hardwood flooring factory, Memphis.

RAND McNALLY
POPULAR MAP OF
**KENTUCKY AND
TENNESSEE**

SCALE 1:2,471,000

1 inch = 20 Statute Miles

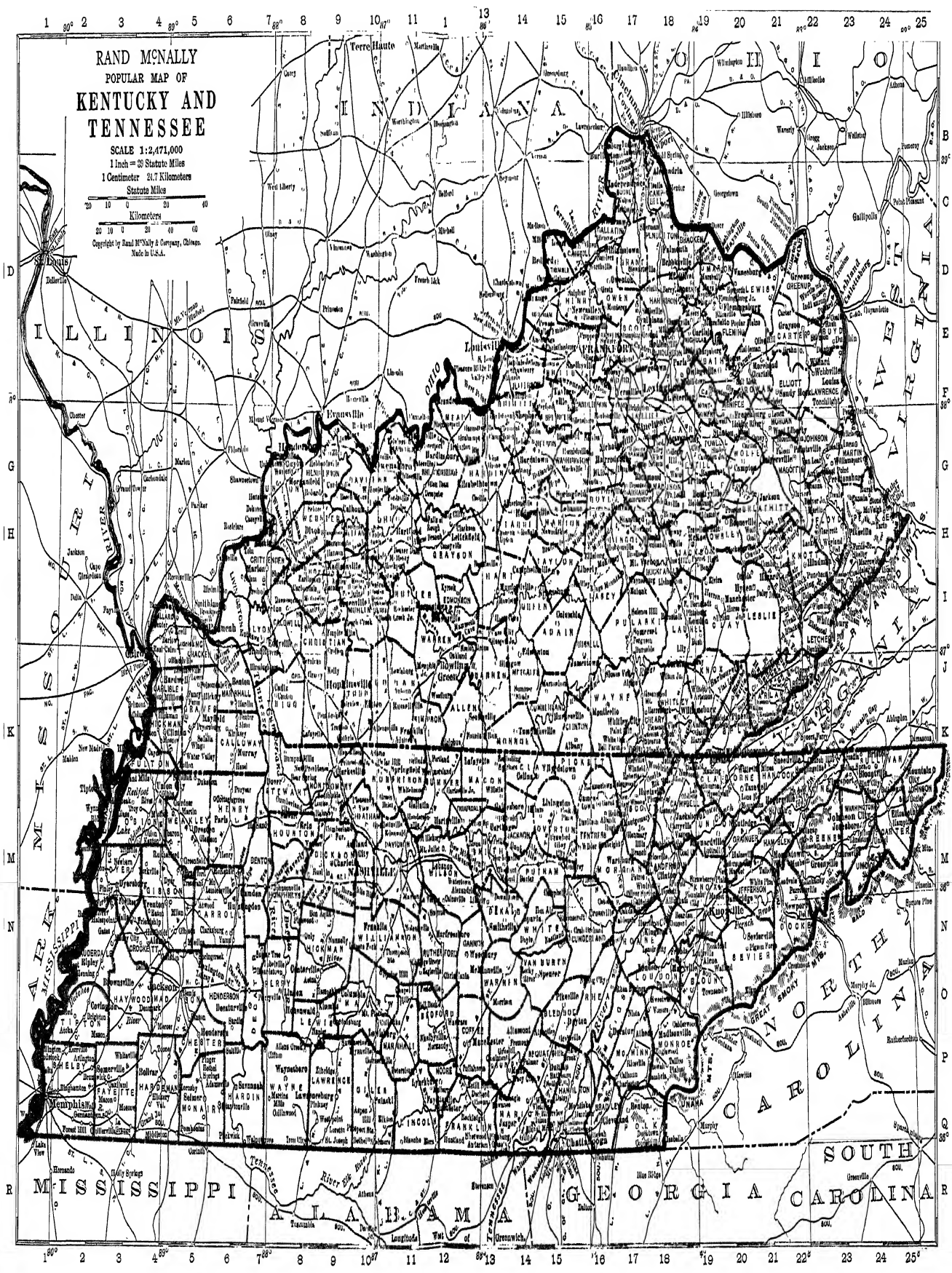
1 Centimeter = 24.7 Kilometers

Statute Miles

Kilometers

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quainted with Tennessee. Thomas Walker recorded his passage through Cumberland Gap in 1750. Between 1756 and 1760 Ft. Loudon was built, garrisoned by British regulars, surrendered to the Cherokees, and its inhabitants traitorously massacred. English settlement began after the Iroquois ceded a shadowy title to the region in 1768; the earliest settlements, along the Holston and Watauga rivers, gained numbers of disgruntled participants in the REGULATION who erroneously believed they were moving into the jurisdiction of Virginia. In 1777 NORTH CAROLINA organized its western lands as Washington Co., extending to the Mississippi. Settlement increased rapidly, and two new counties were created; but the vigorous democracy of the frontier found itself grossly under-represented in the North Carolina legislature, and its wants unconsidered in legislation and administration. The STATE OF FRANKLIN was the result. When the North Carolina legislature remitted unpaid taxes and made other concessions, Gov. John Sevier's commonwealth disappeared; but the separatist movement recurred in intrigues with the Spanish at New Orleans. Meanwhile James Robertson had established a settlement at French Lick in 1779; Davidson Co., with Nashville as its capital, was shortly organized to care for this rapidly growing district. Tennessee was ceded by North Carolina to the United States Feb. 25, 1790, with the stipulation that all general provisions of the ORDINANCE OF 1787, except the prohibition of slavery, should apply. Congress created the "Territory south of the River Ohio" May 26, 1790, with William Blount its first governor and Knoxville as the capital. Tennessee's population in 1795 exceeded 60,000. A state constitution was drafted in January, 1796; Tennessee was admitted to the Union on June 1. Nashville became the capital in 1843. The mountainous part of Tennessee has preserved frontier customs and the colonial vernacular with probably greater fidelity than any other section of the country; it has been distinctive politically and in material progress from western Tennessee, where large-scale agriculture and the commercial interests of Memphis have provided an economic advantage. The Whigs were a major party in *ante-bellum* Tennessee, and the conservative strength was such that in 1860 the state gave its electoral votes to the CONSTITUTIONAL UNION party. The non-slaveholders of the eastern counties were opposed to secession in 1861. Excepting Virginia, Tennessee was the chief battleground of the CIVIL WAR. It was the first Confederate state to be readmitted to the Union, July 24, 1866. After endorsing the Republican candidates in 1920 and 1928, Tennessee returned to the Democratic party in 1932 and gave its 11 electoral votes to Roosevelt. Hill McAlister, Democrat, was elected governor.

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TENNESSEE, UNIVERSITY OF, a state university for men and women, at Knoxville, Tenn. Chartered in 1794 by the "Territory South of the

River Ohio" as Blount College, the institution became the East Tennessee College in 1807, and the East Tennessee University in 1840. On receipt of the benefits of the Federal Land Grant Act in 1869, the university was incorporated as the Agricultural and Mechanical College. Ten years later the name was again changed, the institution becoming the University of Tennessee. The grounds and buildings were valued in 1931 at \$5,513,609. The library contained 96,173 volumes. In 1930-31 there were 3,556 students, and a faculty of 457, headed by Pres. HARCOURT A. MORGAN.

TENNESSEE RIVER, the largest tributary of the Ohio, formed by the junction of the French Broad and Holston rivers in eastern Tennessee, about 4 mi. above Knoxville. It flows southwestward into Alabama, traverses the northern part of that state, reenters Tennessee and thence flows northward across Tennessee and Kentucky to its junction with the Ohio at Paducah. Exclusive of headstreams its length is 652 mi. The upper reaches of the stream cut through several ridges of the Allegheny Mountains, and the middle course is obstructed by Muscle and Colbert Shoals. These shoals have steep slopes, sometimes as much as 15 ft. per mi., shallow depths and swift currents and are splendid water power sites. The Wilson navigable power dam is situated at Muscle Shoals. The banks and bed of the Tennessee are mostly of clay or rock so that the channel is permanent and the water unusually free of sediment. Because of the importance of this river for navigation, improvements of locks and dams are being made to provide a 9 ft. channel from the mouth of the stream to Knoxville. Large cargoes of sand and gravel and lumber and logs are shipped through it. With its tributaries, the Clinch, Hiwassee and Little Tennessee, the Tennessee River drains an area of 40,569 sq. mi. Chattanooga is the largest city on its course.

TENNIEL, SIR JOHN (1820-1914), English artist and cartoonist whose name survives chiefly as that of the illustrator of Lewis Carroll's *Alice in Wonderland* and *Through the Looking Glass*. Called a master of the burlesque in drawing, Tenniel was known throughout his lifetime as the author of the full- and double-page drawings in the magazine *Punch*. Born in Kensington in 1820, he attended the Royal Academy School for a short time and then embarked on his own education in art. His illustrations for Aesop's *Fables* called him to the attention of Mark Lemon, editor of *Punch*, and in 1851 he was asked to become the magazine's cartoonist in association with John Leech. After 1864 he contributed the principal weekly drawing, usually political. When he retired in 1901 there were well over 2,000 cartoons to his credit. Tenniel was given knighthood in 1893. His line drawings for Lewis Carroll's two masterpieces endeared him to thousands of readers. Besides his journalistic drawings he was also well-known for his illustrations, particularly in Dalziel's edition of *The Arabian Nights*, *Lalla Rookh*, *The Ingoldsby Legends*, *Undine* and the works of Edgar Allan Poe.

TENNIS, the term given in America to **LAWN TENNIS**.

TENNUTHKUTCHIN, a division of the KUTCHIN belonging to the northern division of the Athapaskan linguistic stock, now extinct. They occupied formerly the district from the rapids of the Yukon and the mouth of the Porcupine River in Alaska.

TENNYSON, ALFRED, First Baron (1809-92), English poet, was born Aug. 6, 1809, at Somersby, north Lincolnshire, where his father was rector. He was the fourth of 12 children of Rev. Dr. George Clayton Tennyson and Elizabeth (Fytche), daughter of the vicar of Louth in the same county. Brought up at home until he was seven, he was sent to his grandmother's at Louth, where he attended the grammar school for 4 years; returning home, he was prepared by his father for college. An omnivorous reader, especially of poetry, he early wrote verse of great promise. In 1827 he published, with his brother Charles *Poems by Two Brothers*. In 1828 both matriculated at Trinity College, Cambridge, where their elder brother, Frederick, had gone the year before. Here Tennyson became intimate with a remarkable group of young men, including ARTHUR HALLAM, his dearest friend. In 1829, he won the Chancellor's Medal for English verse, with a poem *Timbuctoo*, which was soon followed by *Poems, Chiefly Lyrical*, published and favorably received in 1830. He spent the summer of 1830 in the Pyrenees with his friend Hallam, and in 1831 left Cambridge without taking a degree, owing to his father's ill-health. Hallam, a frequent visitor at Somersby Rectory, fell in love with Tennyson's sister Emily and became engaged to her. In 1832 the poet toured the Rhine country with his friend; a volume of *Poems* printed this year met with an unfavorable review in the *Quarterly*, and checked his publication for 10 years. In 1833 Hallam died suddenly in Vienna—a great blow to Tennyson and to all his family. For some years he remained at home with his mother, reading, writing poetry and polishing earlier poems. He fell in love with his future wife, Emily Sellwood, at his brother's wedding to her sister, but was not able to marry her until 1850. In 1842 the publication of *Poems* in 2 volumes gave him fame as the greatest living poet. The family lost their money as the result of an unfortunate investment, and in 1845 Tennyson received a pension of £200 a year. *The Princess* appeared in 1847, and in 1850, *IN MEMORIAM*, dedicated to Hallam, was published anonymously, but the authorship was known. The volume sold well, though the critics were not prompt in recognizing the merit of the poem. This same year WILLIAM WORDSWORTH died, and the laureateship was offered to Tennyson, who was now able to marry. His *Ode on the Death of the Duke of Wellington* appeared in 1852, on the day of the Duke's funeral. In 1853, he took up his residence on the Isle of Wight, which remained his home for the rest of life, though he traveled frequently in England and on the Continent. Much interested in the Crimean War, he wrote *The Charge of the Light Brigade* in 1854. *Maud*,

appearing in 1855, met with adverse criticism; Tennyson was made D.C.L. by Oxford this year. The Arthurian poems began to appear in 1856, and added much to his popularity; *Enid*, 1856, and *Guinevere*, 1858, were followed by *THE IDYLLS OF THE KING* in 1859, which had a new edition in 1862. *ENOCH ARDEN* and other poems appeared in 1864; *The Holy Grail and Other Poems* in 1869, and a new edition of the *Idylls*, including this and the earlier poems, the same year. *Gareth and Lynette*, and the complete *Idylls*, in the 7-volume *Complete Works*, appeared in 1872. In 1873 and 1874 Tennyson declined a baronetcy; in 1875 his first blank-verse drama, *Queen Mary*, was written, and was produced by Sir Henry Irving in 1876. It was followed by *Harold* and *The Falcon*, the latter acted in 1879, and printed with *The Cup* in 1884. *Ballads and Poems* was published in 1880; *The Cup* was produced in 1881, and *The Promise of May* in 1882 (printed 1886). In 1884 Tennyson accepted a peerage. *Becket* was published 1884 and produced in 1893; and was followed by *Tiresias and Other Poems*, 1885, *Locksley Hall Sixty Years After and Other Poems*, 1886, and *Demeter and Other Poems*, 1889. A serious illness in 1888, and an attack of influenza in 1890, weakened the poet, but he wrote *Lines on the Death of the Duke of Clarence*, 1892, and the *Death of Oenone*, 1892, besides a play on Robin Hood, *The Foresters*, produced in New York in 1891, and in London, 1893. Tennyson died Oct. 6, 1892, and was buried in Westminster Abbey, beside the grave of Robert Browning. Lady Tennyson survived him, dying in 1896.

Tennyson ranks as a poet of individual charm, felicity of diction, imagination and music. He voiced the greatness of England, and his ballads and ode still stir the reader. *In Memoriam* and the Arthurian idylls remain popular. His Lincolnshire dialect poems show his humor, and if at times he is too much inclined to preach, he has a wide sympathy with the joys and griefs of his countrymen. A careful critic of his own art, Tennyson studied perfection in others and sought it in his work; a recluse, he was never out of touch with his time. His keen observation of nature is remarkable, and his philosophy is profound, but he is remembered rather as a lyricist than as a dramatist. See also **ENGLISH LITERATURE**. R. W.

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TENOR, in music, the highest natural male voice having a normal compass from d to bb' although occasionally extending from c to c''. The word is derived from the Latin *tenere*, to hold, being that voice in early ecclesiastical music which held the CANTO FERMO or melody. A dramatic tenor is known in Italian as *tenore robusto*, and in German as *Heldentenor*; the lighter or lyric tenor is similarly known as *tenore di grazia* or *lyrischer tenor*. Applied to several musical instruments, tenor is a term of modifica-

tion; the tenor trombone is so called to distinguish it from a similar instrument of different compass. The tenor CLEF, although seldom used for the voice to-day, is much used in orchestral music. It is the C clef placed on the fourth line of the staff.

TENREC (*Tenrec ecaudatus*), an insectivorous mammal (Order *Insectivora*), found only in Madagascar. This typical tenrec, the largest known insectivore, is 12 to 16 in. long, nearly tailless, and has a large pointed muzzle, strong digging claws and a coat of black coarse hair, bristly along the spine. When attacked it is able to roll into a hedgehog-like ball.

TENSE, a category of the verb which indicates the time of its action or state as distinct from its **ASPECT**. It seems to be of later development than aspect, though evidently existing from a very early period, so that it plays relatively little part in the more conservative types of language, such as Semitic, Caucasian, Indo-Iranian, Baltic, Slavic and Greek. The most primitive tenses would seem to have been present and past, both of these, as well as the perfect, having their old aspectual functions replaced by new meanings of a temporal character, while the future, future perfect and pluperfect were added later.

As a tense, the present denotes especially action now taking place, or conceived as now taking place, so that it may be used in vivid recounting of past events (historical present), and may likewise serve as a future, as "I go to town to-morrow." The past tense still retains in many languages a differentiation between the imperfective (durative) and the perfective (momentary) aspects, the former known as the imperfect and the latter as the aorist.

The imperfect has survived as a separate tense in Indo-Iranian, Greek, Albanian and Celtic; in Armenian it has become the aorist, a new form having been created for the imperfect; in Germanic it has absorbed the old perfect, for which a new form has been found; and in Baltic, Slavic, Italic and Celtic the imperfects are also new types, the Latin type of *amabam*, "I was loving," for instance, apparently being compounded with the Indo-European base **bhewe(i)*- "become." (See separate articles on the above languages.) While the imperfect was formed on the same grade of the **BASE** as the present, the aorist was from the zero-grade, as Greek *e-lip-on* contrasted with *e-leip-on* from *leip-ō*, "leave." It survives only in Indo-Iranian, Albanian, Baltic and Slavic; in Italic and Celtic it is merged in the perfect; in **ROMANCE** it has been recreated, as French *il aime*, "he loved at one time" as contrasted with *il aimait*, "he was loving."

Except for a few sporadic survivals, as Latin *cecini*, "I have sung," Gothic *hai hait*, archaic English *highr*, the perfect tense has survived only in Indo-Iranian and Greek. It is generally characterized by reduplication, the normal grade of the base with the (unintoned) qualitative vocalic grade *o* (see **ALTERNATION**, **VOCALIC**), and by a special set of personal endings, as Greek perfect *le-loip-a*, but aorist

e-lip-on, from *leip-ō*. The perfect has vanished in Armenian, Baltic and Slavic. In Albanian, Romance, Germanic and Modern Greek an entirely new type has been formed by the help of auxiliaries, as French *il a trouvé*, *il est venu*, German *er hat gefunden*, *er ist gekommen*, English "he has found," "he is come," a reminiscence of the earlier meaning lingering on in the types of French *la lettre qu'il a écrite*, German *der Brief den er geschrieben hat*, English "the letter which he has written," i.e., "the letter which he possesses in written state."

The future tense was entirely unknown to the primitive Indo-European language, whose different branches were obliged to form it in various ways. It may be a desiderative present, as English "he will do" = "he wills to do"; a subjunctive, as Latin *dixō*, "I shall say"; or made by various compounds and paraphrases, as Sanskrit *dātasmi*, "I am a giver" = "I shall give," Latin *amabo*, "I become loving" = "I shall love," French *j'aurai*, "I have to have" (**VULGAR LATIN** *ego habere habeo*) = "I shall have," *je vais avoir* = English "I am going to have," German *ich werde haben*, "I become to have," English "I shall have" = "I ought to have," etc. On the analogy of the tense relation of the perfect to the past, a past tense was subsequently created both for the perfect and future, called pluperfect and future perfect respectively.

In **SEMITIC** tense is scarcely expressed, although **SYRIAC** and Modern **HEBREW** use the participle to indicate action now taking place, giving the type "he (is) going" = "he goes"; and **ARABIC** may prefix a particle to the perfect to denote future action, as *sa-qatala*, "he will kill." L. H. G.

TENSILE STRENGTH. See **ELASTICITY**.

TENSION. When a wire is stretched, it is said to be under tension. Tension is represented by a "pull" in contradistinction to **COMPRESSION**, which may be thought of as a "push." Technically, a tension is measured by the force or pull applied per unit of cross-section of the body. This is very well illustrated in Young's Modulus. (See **ELASTICITY**.) The limit of the tension which can be applied to a body is the force which corresponds to its breaking strength, known also as its tensile strength. This is a very important factor in the construction of suspension bridges, where the tensile strength of the wires composing the cables determines the load which the bridge can carry.

TENT CATERPILLAR, the larva of a lepidopterous insect of the family *Lasiocampidae*. The eggs are laid on the twigs of trees, in ring-like masses about 3/4-inch long and 1/2-inch in diameter. The larvæ, which pass the winter in the egg stage, hatch early in the spring and build a silk web or tent in which they all live together, going out to forage on the young leaves. In about a month the larvæ attain full growth, pass to some shelter and change to brown pupæ, later emerging as light brown moths. Two common species (*Malacosoma americana*), the apple tree tent caterpillar, and (*Malacosoma disstria*),

the forest tent caterpillar, are found in the eastern section of the United States; western species include *Malacosoma californica*, infesting oak trees early in the season and *Malacosoma constricta*, found on fruit trees in late summer. All species do much damage and leave unsightly webs and tattered foliage behind them. They can be destroyed by burning the tents or spraying them with kerosene or arsenate of lead.

TEN TRIBES, LOST. See **TRIBES, LOST TEN.**

TENURE OF OFFICE ACT, a bill, passed by Congress Mar. 2, 1867 over President Johnson's veto, which provided that the consent of the Senate be requisite to the dismissal of any officer whose appointment had required the confirmation of the Senate. This abridgment of the President's constitutional power of removal led to the culmination of the strife between Johnson and Congress, the impeachment of the President after he dismissed the Secretary of War, Edwin M. Stanton, on Feb. 21, 1868. Grant, upon becoming President, demanded that the major features of the act be stricken out, and Congress promptly complied. In June 1885, while Congress was in recess, President Cleveland suspended a Federal attorney. The Senate, reconvened, called upon the President to communicate papers relating to the suspension. Cleveland refused, denying the Senate's assumption of authority in removals, and the result was the final repeal, in 1887, of the Tenure of Office Act.

TEOSINTE (*Euchlana mexicana*), a tall, broad-leaved annual grass in appearance somewhat resembling Indian corn to which it is closely allied. It is a native of Mexico where it is more or less planted for forage. The smooth stems, 10 ft. or more high, branch freely at the base forming large clumps. The tassel terminating the stem is like that of Indian corn and the clusters of spikes, enclosed in husks with the long styles (silk) hanging from the top, bear likewise some resemblance to the ears of corn. Teosinte is sparingly grown in the Southern States as a soiling plant. Various hybrids between teosinte and Indian corn occur.

TEPEE. See **TIP.**

TEPLICE-ŠANOV (*Teplitz-Schonau*), a Czechoslovak city and spa in northeastern Bohemia near the Saxon frontier. It has a Catholic church rebuilt in 1700, a modern Gothic Catholic church, a Protestant church, a synagogue, a castle of Prince Clary with a chapel dating from the middle of the 18th century, a monument to Mozart, a vocational and other schools, a museum and theaters. The production of textiles, metal goods, glassware and food products is aided by the large deposits of lignite coal in the district. The city's alkaline-saline, radio-active springs are efficacious in cases of gout, rheumatism and paralysis. The city was founded during the 12th century and efficacy of the baths became known in the 16th. In 1630 the city and castle belonged to Count Kinsky, then to the counts of Aldringen and Clary. Several meetings of monarchs were held there between 1813 and 1860. Nearly all the inhabitants are Germans. Pop. 1921, 28,982; 1930, 30,911.

TEQUENDAMA FALLS, a waterfall in Colombia, near Bogota. The Rio Francisco which traverses the city, joins the Funza and their waters descend through a long, narrow ravine to be precipitated at Tequendama, a magnificent fall of 475 ft., with a volume of over 4,000 cu. ft. per second. The falls are about 36 ft. in width and are remarkable for their height rather than for the volume of water; the whole scene is one of great beauty. It is as if a colossal hand had scooped a tremendous basin out of the mountain, for it is a huge round hole with sheer precipitous cliffs descending to great depth, and steep, wooded mountains all round. Everywhere near the falls are trees of northern growth and fluffy-topped, interwoven and tropical vegetation.

TERAH, according to the **BOOK OF GENESIS**, was the father of **ABRAHAM**. He migrated with his family and relatives from Ur of the Chaldees to Canaan. The Biblical genealogies variously state that he was both the son and the brother of **NAHOR**. Some modern scholars connect him with the moon-cultus of Ur, his first home, and of Haran, where he died. Others discover reasons for thinking him a double of Abraham, and call him a legendary hero of the Jerahmeelites.

TERAMO, a city of east central Italy, capital of the province of the same name. It has a Romanesque cathedral begun in 1154 and restored in the 14th century, Roman remains, and technical and other schools. It is the seat of a bishop. The chief products are olive oil, furniture and hats. Pop. with suburbs, 1931, 30,667.

TERATOLOGY, the study of freaks or monsters, including their abnormal development and heredity. The idea that freaks in man and higher animals are due to strange mental experiences of the mother, called prenatal influences, is no longer accepted by biologists. The relation of mother to fetus being merely nutritive, imperfect placental connections or toxic maternal blood may arrest development at critical moments and produce certain monstrosities. The microbes of tuberculosis and syphilis may have similar effects, but recessive hereditary tendencies, sublethal genes latent in the germ cells of the parents, play a larger rôle. See **GENETICS**.

Double monsters, a form of incomplete twin formation, result from division of the rapidly growing tip of the embryo, at either head or tail. Supernumerary fingers, limbs or other appendages are occasionally found in many kinds of animals. Polydactyly in man is inherited as a Mendelian dominant, i.e., skipping no generation, just as is brachydactyly or short-handedness, in which one set of finger joints are stiff and fused.

Arrest of development of the head end of an embryo results in absence of face and even headlessness. Thus treatment of embryos of sea minnows by magnesium salts resulted, in Stockard's experiments, in cyclopean monsters with a single eye.

In sex-mosaics, gynandromorphs, of animals, the body is a patchwork combination of male and female

characteristics. In plant chimeras, two sorts of tissues, e.g., grape-fruit and orange, are incongruously combined.

J. H. G.

TERAUCHI MASAKATA, SEIKI, COUNT (1852-1919), Japanese soldier and Premier, was born a commoner at Choshi in 1852. He came to wide prominence in July 1909, when he resigned his portfolio as Japanese War Minister to become Resident-General of Korea. In July 1910 he negotiated the treaty of annexation of Korea by Japan. Terauchi ruled Korea with an iron hand, and his repressive measures did much to create the anti-Japanese feeling in that country. His policy as Premier also was notably reactionary and imperialistic. In 1915 he returned to Japan and in 1916-18 served as Premier. He died at Tokio, Nov. 5, 1919.

TERBIUM, a metallic chemical element belonging to the RARE EARTHS, exceedingly scarce in nature. Its chemical symbol is Tb, its atomic weight 159.2. It was first definitely isolated by Urbain in 1904, although its existence, in a mixture with several other rare earths, had been known since 1843.

TERCEIRA. See AZORES.

TEREBINTH, a small tree (*Pistacia Terebinthus*) of the cashew family closely allied to the pistacio and the mastic. It is native to the Mediterranean region and more or less planted as an ornamental, especially in English gardens. The tree bears deciduous pinnate leaves, numerous minute flowers in axillary clusters and small, roundish, bright red fruits (drupes). From incisions made in the trunk is obtained the liquid oleoresin known commercially as Chian, Scio or Cyprus turpentine. See also TURPENTINE.

TEREDO or **SHIPWORM**, the popular names for members of a family of bivalve mollusks which live in the sea and from the earliest times have caused incalculable damage to wooden ships and harbor works. Although the advent of steel and iron hulls has made them innocuous as far as most vessels are concerned, teredos still destroy annually wharf piles, barges and other submerged wooden structures worth millions of dollars.

Most shipworms have greatly elongated, wormlike bodies, a foot or less in length in species of temperate climes. Some tropical forms are six feet long. The bivalve shell, found at one end, is extremely small, and is provided with minute teeth, which serve the animal as a file with which it scrapes its way into the wood. Shipworms live in the burrows which they make, and feed to some extent on the wood itself.

TERENCE (c. 190-c. 159 B.C.), Roman writer of comedies whose full name was Publius Terentius Afer, was born in Carthage, northern Africa, about 190 B.C. For a time he lived as a slave in the house of the Roman senator, Terentius Lucanus, who became his patron, educated and freed him. At 24 the gifted youth produced his first comedy, *Andria*, adapted, as was a custom of those days, from two plays of MENANDER. Entering the brilliant intellectual circle of Rome, which included Scipio Africanus the

Younger and Laelius, who became his intimate friends, Terence produced within a few years the five other plays which are still extant, *Hecyra*, *Heautontimorumenos*, *Eunuchus*, *Phormio* and *Adelphoe*. Going to Greece in 160 B.C. the author died there about a year later, possibly by drowning. Terence's plays are modeled on the New Comedy of Athens, and display an admirable elegance and purity of language, as well as keen analysis of character, although they lack the rollicking humor of the comedies of his celebrated predecessor, PLAUTUS. Dramatists of the 17th and 18th centuries in France and England were indebted to the work of Terence.

TERESA OF THE CHILD JESUS, ST. (1873-97), a French Carmelite nun, was born Marie Françoise Thérèse Martin, at Alençon, Jan. 2, 1873. At the age of 15 she entered the Convent of the Infant Jesus and the Sacred Face, at Lisieux. She died of tuberculosis, Sept. 30, 1897, and was buried in the convent chapel. Her autobiography, written at the command of her superiors and published in 1899, made "the Little Flower of Lisieux" known throughout the Catholic world. Various miracles have been ascribed to her; but she is loved chiefly for the simplicity and perfection of her obedience, her "little way of self-surrender." On May 17, 1925, she was canonized. The patron saint of missions, her feast is celebrated Oct. 3. St. Teresa of the Child Jesus has many shrines in the United States.

TERMAN, LEWIS MADISON (1877-), American psychologist, was born in Johnson, Co., Ind., Jan. 15, 1877. He graduated from Indiana University in 1902 and took his Ph.D. at Clark University in 1905. After serving as professor of psychology and pedagogy at the State Normal School, Los Angeles, 1906-10, he joined the faculty of Stanford University, becoming the head of the department of psychology in 1922. Terman was a member of the board of five psychologists appointed to revise the Army mental test methods for use in schools. His many publications include: *The Teacher's Health*, 1913; *The Measurement of Intelligence*, 1916; *The Stanford Revision of the Binet-Simon Intelligence Scale*, 1916, and *The Terman Group Test*, 1920; with Margaret Lima, *Children's Reading*, 2d. ed., 1931.

TERMITE, the preferred vernacular name applied to all members of the insect order *Isoptera*. The alternative name "white ant" is inept because despite their analagous habits they are neither ants nor relatives of ants. Termites and termitariums are very familiar to residents of the tropics, in all parts of which they are abundant, and their depredations serious. In temperate regions by reason of concealed nests and fewer numbers they are less well known but in the warmer parts of such regions, as in California, their injurious habits are a matter of major economic concern.

The *Isoptera* are the only order of insects that are wholly social (see SOCIAL INSECTS) and they are the only social insects with incomplete metamorphosis. They are exceedingly primitive, and are supposed to

be descendants from roach-like ancestors. The wingless castes shun the open light, to which they are unable to withstand prolonged exposure. As a result, their integument is delicate, and they are white, except a few African species, which forage in the light. In order to protect themselves from exposure termites construct covered passageways to connect their termitaria with their feeding grounds. Some genera nest in the ground, certain species constructing domes of clay which may reach a height of 35 and a diameter of 60 feet. Other genera build arboreal nests of fragments of comminuted wood agglutinated with saliva, or passed through the intestines. Still others live wholly in chambers and galleries constructed below ground or in dead wood. All of the nests are practically shut off from the outside world. The food of termites consists of wood, the presence of certain infusoria in the alimentary canal enabling them to digest cellulose. Many African termites cultivate fungi in their termitaria, and these serve as food only for the immature individuals and the adult sexual forms.

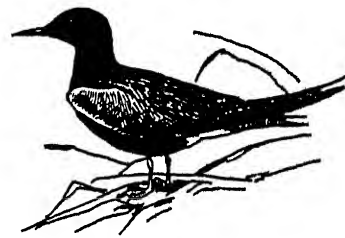
There are eight different castes, each represented by males and females. The most important of these are: 1. First form reproductive males and females. These are deeply pigmented and have compound eyes and wings, the latter being shed after the nuptial flight. Immediately after this occurs male and female cooperate in excavating for a colony, and coition does not occur until their habitation is complete. They become the royal pair and remain associated through life, carefully tended in the royal chamber. In specialized termites the queen becomes an enormous sausage-like egg-laying machine, her abdomen distended to as much as 20,000 times the volume of a worker. 2. Second form adults, with wing-pads and eyes. 3. Third form adults, unpigmented, wingless, with vestigial eyes. These and the preceding have functional reproductive organs, and are substituted for the kings or queens in case of the death of either. 4. Large and 5. Small workers; wingless, unpigmented, eyeless and sterile. Their function is to perform the household work of the colony. This caste is sometimes absent, its function being taken over by young soldiers and sexual forms. 6. Mandibulate soldiers, wingless, unpigmented except the head, which is large and has powerful mandibles. They act as defenders of the termitarium. 7. Nasuti, a special type of soldiers, with vestigial mandibles and small head, the latter provided with a snout-like process through which they eject a liquid effective in defense. J. C. B.

TERMITE-PROOF CONSTRUCTION. Termites, or white ants, are found in many parts of the southern United States. They utilize wood for food, tunneling through it and eating out the inside of the timber with the result that in many cases important wooden members in buildings are seriously weakened. It is difficult to detect the work of the termites since they work from the ground up through the timbering and frequently there is no

indication of their presence on the surface of the wood. There are two methods which may be employed to prevent the termites from attacking wood construction: The *first* consists in impregnating all foundation timber with creosote and other wood work with zinc chloride or other preservatives. The *second* requires that all wood or organic fiber products shall be placed at least 18 inches away from the ground. This may be accomplished by the use of concrete for the basement floors and walls or the use of brick basement walls, provided both faces are thoroughly covered with plaster to prevent the termites from getting into the brick joints and up through the wall to the woodwork. Great care must be exercised in closing all openings and cracks in the floors and walls.

G. A. H.

TERN, a group (*Sterninae*) of long-winged, web-footed swimming birds of the gull family (*Laridae*). There are some 60 species widely distributed throughout the world found most abundantly along ocean shores but occurring also about inland lakes and rivers; about 18 forms are found in North America. They are usually smaller and slimmer than the true gulls, averaging from 12 to 18 in. long, with a more slender, pointed bill, longer wings and an often



G. M.
J. HORN

BLACK TERN

deeply-forked tail. Their plumage is chiefly white, with the back and wings pearly gray and the crown usually black. On the wing terns are stronger, swifter and more graceful than the gulls, whence the oft-applied name sea swallow. When in search of their food, which consists chiefly of small fish, they fly with the bill pointed downward, and, upon spying a suitable catch, plunge rapidly into the water. Terns nest usually in colonies on bare sands or rocks near the water, though some resort to forest trees and lay one to four variable spotted eggs. Among the best known species found in North America are the common or Wilson's tern (*Sterna hirundo*), of the Atlantic coast, nesting extensively in the interior; Forster's tern (*S. forsteri*), found generally throughout the continent; the arctic tern (*S. paradisaea*), breeding from the arctic to Massachusetts and wintering southward to the antarctic, and the gull-billed tern (*Gelochelidon nilotica*), of nearly world-wide distribution, ranging northward on the Atlantic coast to Massachusetts.

A. B. J.

TERNATE, an island of the Moluccas Archipelago, in the Dutch East Indies. It lies west of Gilolo Island

and comprises a territory of about 25 sq. mi. With a number of other islands it forms a residency of the government of the Moluccas. The largest town, Ternate, is the capital of the island and of the residency of Ternate. The island is of volcanic origin and contains a mountain which rises to about 6,000 ft. above the sea. Nutmegs, tobacco, rice, maize, coffee and sago are the chief products. Pop. 1927, town of Ternate, 6,000; of the residency, 284,818.

TERNE PLATE. See TIN AND TERNE PLATE.

TERNI, a town of Italy, capital of the province of Umbria in the Apennines, 426 ft. above sea-level in the valley of the Nera, and 49 mi. northeast of Rome. Terni is a smelting center and supports a large industrial population. The Italian government maintains an arsenal at Terni. The famous Falls of Terni are a few miles east of the town. Recent archeological excavations on the site of Terni disclosed an ancient Neolithic village dating back to 1200 B.C. Pop. 1931, 62,741.

TERPENES, a term that should be restricted to the alicyclic hydrocarbon $C_{10}H_{16}$, contained as pinene and limonene in oil of TURPENTINE. Closely related compounds are sesquiterpenes, $C_{15}H_{24}$, polyterpene, $C_{30}H_{48}$, and hydroterpenes containing more than 16 atoms of hydrogen to 10 atoms of carbon. Terpenes in nature are associated with the products which have probably been formed from them, or simultaneously with them by polymerization, oxidation, etc. Oil of turpentine is the best example.

TERPSICHOE, in Greek mythology, one of the Muses. Later she was called the Muse of simple lyric poetry.

TERRACING, the construction of level steps or platforms of earth, usually on the side of a hill or slope. It is the most effective method for controlling soil erosion. While there are several different types of terraces, each suited to some special conditions, the type best adapted to use in the United States is commonly called the broad-based or Manguum terrace. This consists of a broad ridge of earth, from 20-30 ft. wide and from 15-20 ins. high, thrown up across the hillside and having, in the direction of its length, a slope or fall to carry the surface water to the outlet channels at its lower end. This fall is slight at the upper end but constantly increases toward the outlet end.

In throwing up this ridge a broad channel is formed along its upper side through which the collected water flows at low velocity. This type of terrace can be crossed readily and without damage by modern farm machinery. Terraces may be planted to crops and cultivated with the rest of the field. On sandy soils the terraces can be constructed level if left with open ends. L. A. J.

TERRA COTTA, a hard baked clay of extremely fine texture used for statuary and for architectural ornament, sometimes called artificial stone. The natural color of terra cotta depends upon the mixture and character of clay and the degree of firing. It is usually a pinkish orange, varying from very pale to a

brownish orange or a brick color. It is a very enduring medium for sculpture; although it breaks more easily than wood or stone, it is the only medium that will withstand fire. Terra cotta has been known and used since antiquity. Excavations at the palace of Minos at Knossos on the island of Crete have unearthed miniature animal forms, human figurines, including the famous snake goddess, and wall decorations modeled of terra cotta between 1900 and 1700 B.C. which are unrivaled by anything produced in subsequent ancient or modern times. The famous Tanagra figurines date from the 3rd-5th century B.C. and were found at the necropolis of Tanagra and also at Myrina. Some are gilded; some are painted, and all show strongly the influence of Greek sculptors of the 4th century B.C. Interesting terra cottas have been found at Machu Picchu in Peru, including pottery vases, small statuary, dice, or tally pieces, and a whistle of odd shape. The famous Della Robbia ware of the Middle Ages, made by the Della Robbia family of Italy, was of terra cotta with a colored enamel glaze. In 18th century France, terra cotta was widely used for statues, statuettes, vases, clocks and bric-a-brac. The outstanding makers were Jean Antoine Houdon and Claude Michel, commonly known as Clodion. In present-day France, terra cotta is a favorite medium for portrait statuary. The Germans are also using it for interesting modernistic sculpture. In the United States it is extensively used for architectural decoration. X.

In the manufacture of terra cotta, dense-burning, semi-fire clays are generally used as the raw ingredients. These are made plastic by grinding and mixing with water, and then are formed into shape in plaster molds. After the glazing material is applied to the dried piece by spraying, the product is burned at 2100 to 2300° F. The body become vitreous, and the glaze melts to form a glass-like surface. Being a burned clay product, terra cotta can be molded into a variety of shapes and designs, and glazed with any desirable color. See CLAY PRODUCTS. L. C. H.

TERRAPIN, a popular name for fresh-water tortoises, and certain other chelonians which inhabit brackish water and salt marshes. They have broad, flattened shells and are semi-aquatic in habit. There is no distinct family, or closely related group of terrapins, and the term is sometimes rather loosely applied. A number of species are found in the United States. The most valuable, economically, is the diamond-backed terrapin (*Malacolemys centrata* or *palustris*), whose flesh is considered a great delicacy. It lives in salt marshes and brackish rivers along the Atlantic coast, and Gulf of Mexico. Another excellent edible species is the red-bellied terrapin or slider (*Pseudemys rubriventris*) which frequents the fresh waters of southeastern rivers. See also ELLACHICK.

TERRE HAUTE, one of the oldest cities of Indiana, and county seat of Vigo Co., on the Wabash River, 72 mi. west and south of Indianapolis. Its transportation facilities include four railroads, numerous motor bus and truck lines and airmail service.

The city carries on the trade of the surrounding farming and coal-mining region. There are iron and steel works, railroad shops, and, among its mills, one that has ground grain for 100 years. In 1929 the manufactures reached approximately \$28,000,000; the retail trade amounted to \$38,563,739. The city has ten parks and playgrounds, with a total area of over 500 acres, and 25 mi. south is Shakamak State Park. Turkey Run State Park is 35 mi. north of Terre Haute. Terre Haute is the home of the State Teachers' College and of Rose Polytechnic Institute and in the vicinity is a Catholic College for girls, St. Mary-of-the-Woods, established in 1840. On the site of Ft. Harrison, scene of a battle in the War of 1812, the settlement of Terre Haute developed and became a town in 1816, and a city in 1853. Pop. 1920, 66,083; 1930, 62,810.

TERRELL, a city in Kaufman Co. in northeastern Texas, situated 32 mi. east of Dallas. Bus lines and two railroads serve the city. Cotton, grain and vegetables are the principal crops of the region; and cotton-seed oil products and flour comprise the chief manufactures. An extensive system of farm demonstration work, begun by W. C. Porter, is carried on near the city. Terrell was founded in 1873 and incorporated in 1885. Pop. 1920, 8,349; 1930, 8,795.

TERRESTRIAL MAGNETISM. The earth behaves as though it were a huge magnet. As such, it has a magnetic field enveloping it and passing through it similar to a magnet. It has a north and south magnetic pole and a magnetic axis. These do not coincide with the geographical poles and axis. Since the north-seeking pole of a magnet is called the positive pole, and inasmuch as unlike poles attract, it follows that the the north magnetic pole is really a south-seeking negative pole.

It is not definitely known just what is the cause of the earth's field, whether it is an **ELECTROMAGNET** or a **MAGNET**. At any rate, the earth has a magnetic field which is varying in all sorts of ways and these variations are interesting subjects of investigation, because they may lead to an understanding of the causes of the earth's field.

The principal factors or elements in the earth's magnetic field are: 1. Total intensity; 2. Horizontal component; 3. Vertical component; 4. Declination; 5. Inclination. All of these factors are continually changing and the principal changes are: 1. Diurnal or daily; 2. Annular; 3. Secular; 4. Magnetic storms; 5. Minor periodic variations.

1. **Diurnal or daily variations.**—These occur in all of the principal factors which enter into the earth's field. There is the daily variation in declination and inclination. Every 24 hours there is a change in the total intensity which brings corresponding changes in the vertical and horizontal components.

2. **Annual variation.**—This variation is smaller than the daily and yet a very distinct one. It produces variations in all of the elements of the earth's field also.

3. **Secular variations.**—These variations are much

more marked than the others. They occur over long ranges of time. L. A. Bauer has shown that if a magnetic needle is suspended so as to swing freely both about a vertical and a horizontal axis that the north-seeking pole describes a closed circuit over a period of 500-600 years. Such a curve is simply a combination of the secular change in the declination and inclination.

4. **Magnetic storms.**—These are changes which occur suddenly and last at most only a few days. They may be very violent while they last. Simultaneously, brilliant auroras are observed and earth currents are developed of such a magnitude that telephone and telegraph services are often put out of commission. Magnetic storms are classified, according to Bauer, as, "1. Cosmic ones, due to changes occurring in the regions above; 2. Telluric ones, resulting from changes within the interior of the earth, and 3. Regional or local ones, resulting from changes within or external to the earth's crust."

5. **Minor periodic variations.**—Among these disturbances may be mentioned those due to the sun, moon and planets. Lightning, earthquakes and eclipses of the sun may also be classified under this head. It should be kept in mind, that there are no hard and fast lines drawn which separate the various forms of disturbances observed in the earth's magnetic field.

One of the outstanding variations is the 11-year period. This seems to follow the 11-year periodicity observed in sun-spots and northern lights.

Many theories have been advanced to account for the earth's magnetic field and the variations observed. Gauss came to the conclusion that the earth's field was due mostly to internal magnetism. Schuster, by a similar line of procedure, came to the conclusion that the variations were due to external causes. These theories still form one of the interesting problems concerning terrestrial magnetism.

At stations scattered over the surface of the earth, there are recording devices for registering the elements of the earth's field and their variations. The Carnegie Institution in Washington carried out extensive observations on the seven seas by means of their non-magnetic boat, the Carnegie. At land stations, where rigid foundations may be had, recording instruments are set up, called magnetographs. These are sensitive **MAGNETOMETERS** whose deflections register not only the absolute values but the variations as well. The registrations occur photographically. These observations will become more and more valuable as they accumulate. The United States Coast and Geodetic Survey also have a large number of magnetic observatories scattered over the earth's surface, the principal one being at Cheltenham, Maryland. S. R. W.

BIBLIOGRAPHY.—L. A. Bauer, *Principal Facts of the Earth's Magnetism*, U.S. Magnetic Declination Tables and Isogonic Charts for 1902; S. R. Williams, *Magnetic Phenomena*, 1930.

TERRIERS, dogs originally developed for hunting small game, especially rats, but to-day preferred as

TERRA COTTA

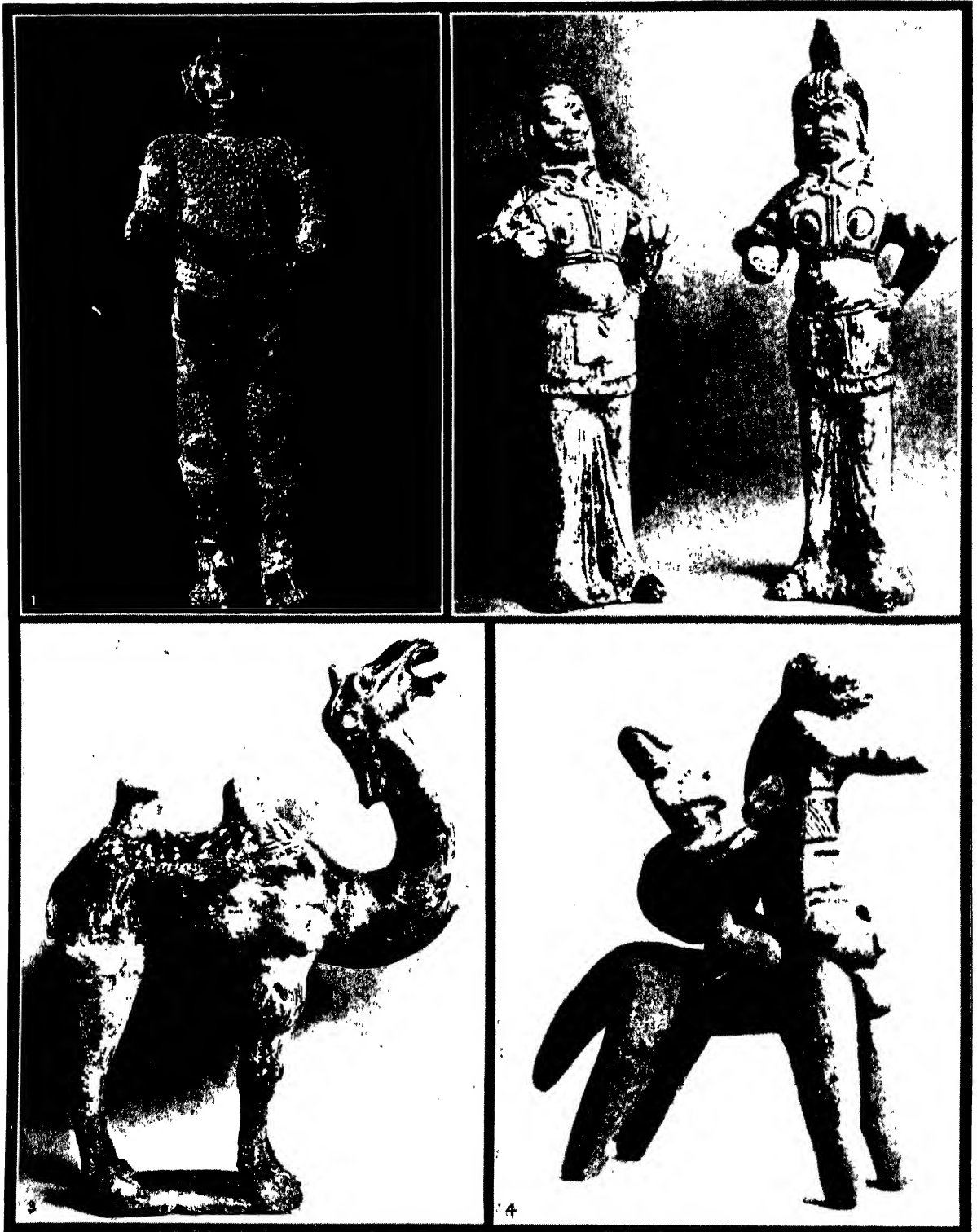


COURTESY METROPOLITAN MUSEUM OF ART

CLASSICAL GREEK TERRA COTTA

1. Statuette of woman with veil and hat, a Tanagra figurine, 2nd-3rd century B.C.
2. Fragment of relief of Eurykleia washing the feet of Odysseus. 5th century B.C.
3. Classical figurine.
4. Woman enveloped in a himation.

TERRA COTTA



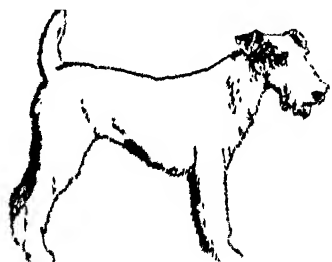
1. COURTESY AMERICAN MUSEUM OF NATURAL HISTORY; 2, 3, 4. METROPOLITAN MUSEUM OF ART

MEXICAN, CHINESE AND CYPRIAN TERRA COTTA

1. Mexican terra cotta figure of warrior in quilted armor, found in a cave at Coatlinchan. 2. Warriors in helmets, cuirasses and long skirts, Chinese, northern T'ang Dynasty

(618-906 A.D.). 3. Mortuary figure of a camel, Chinese, Han Dynasty (206 B.C.-220 A.D.). 4. Statuette group of a horseman from the Mediterranean island of Cyprus.

pets and companions. They range from the fearless Irish terrier, perhaps the oldest terrier known, to the comparatively modern Airedale, which has hunted bear and lion. Others are the speedy Bedlington; border terriers, tireless and hardy; bullterriers, gladiators of the canine world; Cairns, small, sturdy, intelligent; Dandie Dinmonts, which "will tackle anything with fur;" foxterriers, smooth and wirehaired; Kerry



WIRE-HAIRED FOX TERRIER

blues, which also herd sheep; Manchesters, once called rat terriers; game German miniature Pinschers; Schnauzers, often matched in rapping contests, and miniature Schnauzers; the popular Scottish terrier;



SCOTCH TERRIER

courageous Sealyhams; the plumy Skye and Yorkshire terriers; Welsh terriers; and West Highland white terriers, small, game, companionable animals.

TERRITORIAL WATERS, the marginal seas and waters adjacent to the coast of a country and which form a definite part of its territory for purposes of jurisdiction and control, which is coextensive with territory. The general agreement is that the limits of the territorial waters of a state extend three nautical miles seaward (*see* **THREE MILE LIMIT**). In the case of bays which are more than ten miles wide from headland to headland, the territorial limits follow the sinuosities of the coast. Where the headlands are less than ten miles apart, the territorial limits extend three miles seaward from a line drawn from headland to headland. In 1930 an attempt to codify the law of territorial waters failed. C. E. MA.

TERROR, REIGN OF. *See* **REIGN OF TERROR.**

TERRY, CHARLES S. (1864-), British historian, was born in 1864. He was educated at Cambridge, and became a well-known lecturer and writer

on history. He lectured on history at the Durham College of Science and at Cambridge University from 1890-98; then lectured at Aberdeen University, and was professor of history there from 1903-30. His writings cover a wide field of research; among them are *Life and Campaigns of Alexander Leslie*, *The Rising of 1745*, *The Chevalier de St. George*, *A short History of Europe* and *History of Scotland*. He has also published works on the compositions of Johann Sebastian Bach, German composer.

TERRY, DAME ELLEN ALICIA (1848-1928), English actress, was born at Coventry, Feb. 27, 1848, and made her first appearance at eight as the boy Mamillius in *The Winter's Tale*, under CHARLES KEAN. After being in stock in Bristol she went to the Haymarket Theatre, London, 1863. Charles Reade said of her at this time: "Her expression kills any pretty face beside her. She is a pattern of fawn-like grace." In 1864 she was married to G. F. Watts, the painter, but they separated soon after. Her second husband was E. W. Godwin, an architect; her two children by this marriage were Edith and EDWARD GORDON CRAIG. One of her first successes was her Olivia in *The Vicar of Wakefield*. After her marriage to E. H. Wardell (Kelly) she retired, but returned to the stage in 1874. Her association with SIR HENRY IRVING at the Lyceum began Dec. 1878, as Ophelia to his Hamlet. A long series of notable impersonations with him followed: Portia, Juliet, Beatrice, Marguerite, Nance Oldfield, and others until 1902, when she organized her own company. She first appeared in New York city in *Charles I*, Oct. 30, 1883, and toured the United States on several occasions with Irving. In 1910 and 1914 she returned to lecture on Shakespeare. Later she made only occasional appearances at charity benefits in England. In 1925 she was created Dame, receiving the Grand Cross of the Order of the British Empire. Ellen Terry died at Small Hythe, Kent, July 31, 1928.

TERTIARIES, members of secular or regular Third Orders sponsored by certain religious orders (the Augustinians, Carmelites, Dominicans, Franciscans, Minims, Premonstratensians, Servites and Trinitarians). Secular tertiaries observe the Third Rule, living in the world; regulars take vows in community life. The tertiaries have the privilege of being buried in the habit of their Order. The idea of lay participation in the privileges of religious orders dates from the 13th century. Most Third Orders are patterned on that of St. Francis.

TERTIARY PERIOD, the first of the two subdivisions of the CENOZOIC ERA of geological history. It includes the Eocene, Oligocene, Miocene and Pliocene Epochs. The second subdivision, including modern times, is the Quaternary Period.

TERTULLIAN (c. 160-222), Latinist and churchman, was born at Carthage of pagan parentage. He received an excellent education in rhetoric and law, and knew Latin and Greek equally well. In early manhood, he was converted to Christianity and became a priest in his native city. He defended

the faith against its critics with much vigor, but some time later in his life he embraced the Montanist heresy and left the Church. Thereafter he wrote several books in defense of the doctrine of Montanus, in which the Church was criticized unsparingly. Tertullian was the creator of ecclesiastical Latinity and the author of numerous works, mainly of a polemical nature. The best known is his *Apologeticum*, or defense of Christianity, composed about 197. His productions written in the colloquial language of the time, reflect faithfully his own stern, uncompromising and passionate nature.

TESCHEN. See CIESZYN.

TESLA, NIKOLA. See DIATHERMY.

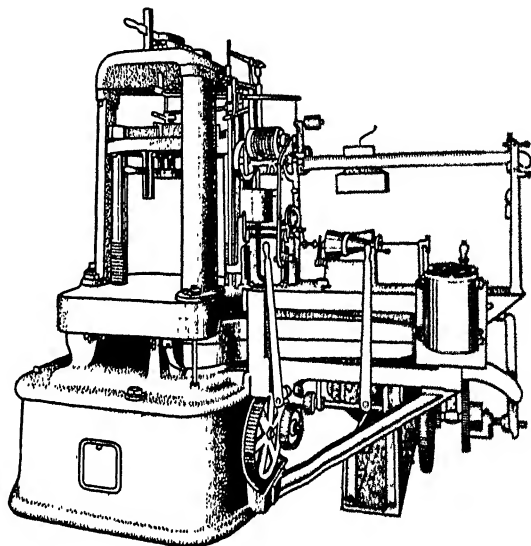
TESS OF THE D'URBERVILLES, a novel of fatalistic, grim tragedy, by THOMAS HARDY; published 1891. Laid in the author's fictitious "Wessex" county in England and containing some of his finest descriptions of rural life and nature, this is the tragic history of the beautiful and sensitive Tess Derbyfield, a country girl whose evil fate begins when she is betrayed by the unscrupulous Alec D'Urberville. The child which is born of this seduction providentially dies, and Tess, going to another part of the county, meets Angel Clare. The honest Tess confesses, on the day of her wedding with Angel, the tragedy of her past. Angel, cruelly shocked, leaves his bride, and Alec, suddenly reappearing, wantonly interferes with a reconciliation between the newly wedded lovers. Driven to despair, Tess kills her tormentor, and goes resignedly to the gallows.

TESTIMONY, PSYCHOLOGY OF, in religion is largely a matter of suggestion. It may be a case of suggestion releasing a response.

In law a testimony is either a written or spoken statement from a witness under affirmation or oath. That it is subject to the personal equation may be well illustrated by an experiment in which a number of persons testify as to what they saw in a staged automobile accident. Ordinarily there will be considerable difference of opinion among the witnesses. Even first-hand testimonies vary in accuracy. The senses do not report the same thing to different individuals. What each sees depends upon his interest and the circumstances under which the observations are made. See EVIDENCE.

TESTING MACHINES, a term usually referring to the so-called *universal* type testing machines which may be used for testing specimens in tension, compression, or flexure. There are two types. In the first the load is applied by a movable cross-head operating on two or three vertical screws (see figure). The load is applied against a weighing table, which in turn transfers it through a system of beams and knife-edges to the weighing beam where the magnitude of the load is determined, as in SCALES. The weighing beam must be kept balanced at all times in order to know the load. In the *hydraulic* type, oil under pressure is forced into a cylinder and against the ram which applies the load. The amount of the load may be measured by a self-indicating Bour-

don Gauge connected to the oil pressure cylinder. In the Swiss Amsler machine, a small auxiliary ram moves a heavy pendulum, the amount of the movement being a function of the pressure applied on

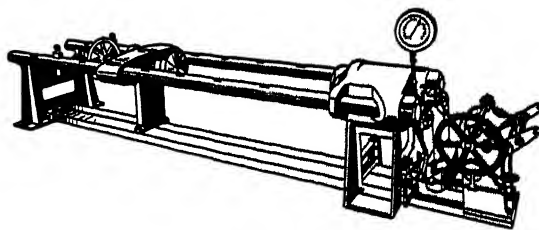


COURTESY TINIUS OLSEN TESTING MACHINE CO.

UNIVERSAL TESTING MACHINE

Load is applied by a movable cross-head operating on three vertical screws

the test specimen and is measured on a self-indicating dial. In the Emery-Tatnall hydraulic machine a sealed weighing capsule is used, consisting of a shallow cylinder, a block and a thin metallic diaphragm. The load is shown on a weighing beam or on a self-indicating dial.



COURTESY TINIUS OLSEN TESTING MACHINE CO.

HYDRAULIC COMPRESSION TESTING MACHINE

The U.S. Bureau of Standards has a compression machine of 10,000,000-pound capacity. Machines of 100,000 to 300,000-pound capacity are fairly common in college, government and commercial laboratories. The new machine (tension and compression) at the University of California has a capacity of 4,000,000 pounds.

E. F. B.

TESTIS, a paired, flattened, oval body, present only in the male of all higher (craniate) vertebrate animals, having as its function the formation of sperm cells. When a sperm cell unites with an ovum or egg, pro-

duced by the female, a new individual is formed. In the human child the testis is very small until the fifth year of life. During childhood it grows somewhat, but at puberty begins to form mature sperm cells, and enlarges considerably.

The testis also secretes a hormone which is responsible for the development of secondary sexual characteristics. For anatomy see *GENERATIVE ORGANS*.

TESTS, PSYCHOLOGICAL, a term applied to the technique of measuring psychological traits objectively. They arose out of a desire to measure individual differences by exact scientific and experimental methods instead of by methods of subjective judgment and opinions. The foundations of the testing movement were laid by FRANCIS GALTON who in his *Hereditary Genius*, 1869, attempted to set up a scale for measuring general intelligence by statistical methods. In the United States J. McKEEN CATTELL first applied the term test to this type of investigation in 1890 when he pleaded in an article in *Mind* for the establishment of norms and standardization of techniques. In Germany the same types of investigation were introduced by Prof. Wilhelm Wundt in 1879 at the University of Leipzig. The most important contribution to the testing of intelligence was made by ALFRED BINET who with the cooperation of Simon constructed a scale known as the Binet-Simon scale. The work of these pioneers was largely developed and extended by Professors EDWARD L. THORNDIKE, CHARLES H. JUDD, Lightner Witmer, LEWIS TERMAN, and a host of their disciples. The Binet-Simon Scale was revised and adapted to American conditions, and the application of tests was expanded to the measurement not only of intelligence but of educational achievement, personality traits and character, vocational aptitudes, and so on. They received their widest application during the Great War to the selection and training of the army. Since then tests have become an important adjunct of school procedure in the United States. They are being developed, but somewhat more cautiously, in other countries. See *EXPERIMENTAL EDUCATION*.

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TESTS OF MATERIALS. See *MATERIALS TESTING* and tests described under the particular material in question, as, e.g., *TAR TESTING* or *CEMENT TESTING*, etc.

TESUQUE, the southernmost of the pueblos occupied by Tanoan-speaking Indians, situated 8 miles north of Santa Fe, N.M. The original site, about 3 miles east of the present settlement, was probably deserted during the Pueblo Revolt of 1680-92. A Spanish mission was established in Tesuque in the 17th century but was abandoned in 1760 and the pueblo reduced to a visita. The inhabitants are divided into two groups, the Winter and Summer Peo-

ple, each with its own chief. Unlike most Pueblo people descent is paternal.

TETANUS. Tetanus or lockjaw is caused by the *Bacillus tetani*, a rod-shaped germ, commonly found in the intestinal tract of horses and in soil. The tetanus germs form spores that may lie dormant in the soil for years and regain the power to multiply when they gain entrance to human tissues.

The tetanus germ cannot grow in the presence of oxygen. For this reason open cuts seldom cause tetanus. Nail punctures and gunshot wounds which are deep, thus closing in the infected matter, are common sites for tetanus. The germs grow and produce a toxin which circulates in the blood. After from four to ten days, the toxin is absorbed by the cells in the spinal cord. The cells become highly irritable and the slightest stimulus causes convulsions. The muscles of the jaw become stiff, hence the name lockjaw. The violent convulsions usually end in death from inability to breathe or from exhaustion.

Although tetanus is a fatal disease, it can be prevented. All cases of punctured wounds and all wounds with the introduction of dirt require prompt surgical treatment. This is followed by the injection of a small dose (1000 units) of tetanus antitoxin.

Tetanus may develop at any time between one and twenty days after an untreated wound. The average incubation period is about nine days. Occasionally the disease may be cured after its development by the injection of massive doses of tetanus antitoxin.

W. I. F.

Tetanus in Livestock. As in man, tetanus is caused by the *Bacillus tetani* which is present in the earth and enters the system through a cut or wound. The bacilli do not enter the circulation but remain in the wound, the terrible effects of the disease being due to a toxin which affects the nerve trunks and spinal cord. The prognosis is unfavorable, though in some cases treatment with tetanus antitoxin has been successful.

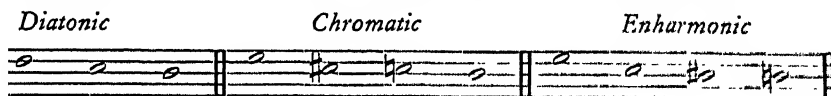
TETANY. See *COD LIVER OIL*; *CONVULSIONS*.

TETON, the largest of the seven primary divisions or "council fires" of the DAKOTA, belonging to the Siouan linguistic stock. The tribe lived chiefly west of the Missouri River in North and South Dakota, and were subdivided into eight large and practically independent groups of which the most important was the Oglala. They lived the typical wandering life of the Plains Indians, subsisting on the products of the hunt supplemented by seasonable wild vegetables and fruits. Their dwellings were of buffalo-skin and their clothing was also made of skins, elaborately decorated for ceremonial occasions. They are now residing on reservations in both North and South Dakota.

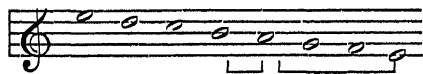
TETON RANGE, a division of the Rocky Mountains, situated in northwestern Wyoming just south of Yellowstone Park. Its general direction is north and south for a distance of 40 mi. The eastern face of the range rises with abrupt ascents above Jackson Hole, a part of the Snake River valley, and on the

west descends more gradually to Teton basin. Both slopes are deeply carved by water and ice. The granite crestline, covered with snow for several thousand feet above the timber line, is gashed into sharply pointed peaks, many of which are over 12,000 ft. above sea level. Mt. Moran which towers to a height of 12,100 ft. above Jackson Lake, has so far defied ascent because the last 3,000 ft. of its slope consists of almost perpendicular walls of rock. To the south of Moran are a number of serried peaks culminating in the giant Grand Teton, the highest point in the range, measuring 13,747 ft.

TETRACHORD, a series of four musical tones which were the basis of Greek music (*see* MUSIC: *Greek*) and from which the octave-scale was developed. The maximum compass of the tetrachord was the fourth, the intermediate intervals of which had different sizes in accordance with varied methods of tuning the lyre, originally a four-string instrument. There were three different methods of tuning the lyre, yielding three different genera known as the diatonic genus, the chromatic genus, and the enharmonic genus. These may be illustrated as follows:



In order to extend the compass of the tetrachord, Terpander about 676 B.C. built a seven-tone scale by taking the diatonic tetrachord and placing another similar tetrachord beneath it, using the final, or lowest, tone of the first tetrachord as the first, or highest, tone of the second tetrachord; this middle tone, common to both tetrachords, was called the *mesē*, or middle, thus:



The second of these tetrachords, being separated by the interval of a TONE, was called the disjunct or diazeutic tetrachord, just as the separating interval was called the disjunct or diazeutic tone.

TETRA-ETHYL LEAD, a colorless liquid, formula $\text{Pb}(\text{C}_2\text{H}_5)_4$. It is heavier than water, having the specific gravity 1.6528 at 20° C. It is stable in the dark and at atmospheric temperatures, but is decomposed slowly in sunlight, and also when heated below its boiling point at atmospheric pressure. But under 13 mm. pressure it distills at 82° C. It may be prepared by any one of several methods, the one used commercially being the interaction of ethyl

chloride and a lead-sodium alloy to give tetraethyl lead and sodium chloride. The principal use of tetraethyl lead is as an ANTI-KNOCK COMPOUND.

T. A. B.

TETRAGONAL SYSTEM, in CRYSTALLOGRAPHY, a system in which minerals are said to crystallize when their faces can conveniently be described by referring them to three imaginary axes, intersecting at right angles at the center of the crystal. One is shorter or longer than the other two, which are of equal length.

TETRAHEDRITE, the sulphide of antimony and copper which often serves as an ORE of copper. It sometimes carries enough silver to serve also as an ore of that metal. In color it is steel gray to iron black, a fact responsible for its common name, "Gray copper." Tetrahedrite crystallizes in the ISOMETRIC SYSTEM. Mining regions where it is found, usually associated with other copper or silver ores, include fields in Montana, Utah and Colorado; it is also found in Chili and Germany. *See also* ORE DEPOSITS.

TETRAHEDRON, a polyhedron of four sides (Greek, *tetra*, four, + *hedra*, seat). The sides are all

triangles. A pyramid with a triangular base illustrates this solid. *See* POLYHEDRON; SOLIDS, GEOMETRIC.

TETRAVALENT. *See* VALENCE.

TETRAZZINI, LUISA (1874-), Italian coloratura soprano, was born at Florence in 1874, the daughter of a merchant. She made her début in *L'Africana* at Florence in 1895. Subsequently she made successful tours of Italy, Spain, Russia and South America. In 1907 she appeared in London in *La Traviata*, singing the same rôle at her début at New York, in the Manhattan Opera House, on Jan. 15, 1908. In 1913-14 she was a member of the Chicago Opera Co. In 1921 she published *My Life of Song*.

TETUAN, also Tetwan, a town of Morocco in the Spanish zone, situated on the River Martil, near the Mediterranean Sea, lying about 30 mi. southeast of Tangier in a fertile plain. In the background are lofty mountains, which add to the picturesqueness of the scene, already striking by the many mosques and the Moorish architecture of the houses. Fruits, especially oranges and grapes, are grown in abundance in the environs. Leather goods, silk and woolen stuffs are the chief articles of manufacture. Pop. 1926, 24,000.

TETZEL, JOHANN (1465-1519), a Dominican monk who was the first to oppose MARTIN LUTHER, was born at Pirna, in Meissen, in 1465, and was educated at Leipzig. In 1516 he came to public attention by Luther's denunciation of his sale of indulgences. Tetzel answered the reformer in a group of theses published in 1518. He died at Leipzig, Aug. 11, 1519.

TEUTOBERGER WALD, BATTLE OF, 9 A.D., a battle fought by the German tribes, particularly the Cherusicans, led by Arminius, against the Roman general Quintilius Varus, commanding an army of 27,000 men. Arminius, a German, trained as a Roman soldier, was incensed at the treatment of his people by Varus. Through trickery Arminius persuaded Varus to move from his strongly fortified Rhenish headquarters and attempt to suppress an uprising among outlying German tribes, which Arminius himself had stirred up. Marching to Aliso through the forests, Arminius, bringing up the rear guard, was able to signal the approach to the waiting German tribesmen. The Germans fell on Varus and his troops when they emerged from Teutoberg forest. The Roman army was cut to pieces. This battle ended Rome's effort to extend her Gallic frontier eastward. Henceforth the Rhine remained the boundary between the Empire and the Germans.

TEUTONIC ORDER or Teutonic Knights of St. Mary's Hospital at Jerusalem, founded at Acre, in 1190, by a group of German merchants. Originally of the hospitaler type, it was later converted to a chivalric order. It differed from the other two great orders that arose from the Crusades, the Knights Templar and the Knights of Malta, in that it was purely German. In the 13th century, the Teutonic Knights turned their attention from Palestine to Prussia and embarked on a campaign of conquest and Christianization of that country which, after a long and bitter struggle with its pagan inhabitants, left them masters of a rich and extensive territory. The Order rose to its greatest power in the 14th century, but a disastrous, century-long war against Poland resulted in its gradual decline. In 1525 the grand master, Albert of Brandenburg, having embraced Protestantism, turned over the Prussian territory of the Order to the King of Poland, and received it back again as a hereditary duchy. Napoleon in 1809 abolished the Teutonic Order and confiscated its remaining possessions. It was revived in 1834 as an Imperial Austrian order.

Tewa, the name applied to a number of Pueblo Indian tribes speaking dialects of the North American Indian Tanoan linguistic stock. The Tewa pueblos are San Ildefonso, San Juan, Santa Clara, Nambe, Tesuque and Hano, all except the last being situated in the Rio Grande valley in northern New Mexico. Hano is the easternmost of the Hopi villages in northeastern Arizona. Another pueblo, Pojoaque, was occupied by Tewan peoples until recently, but intermarriage with Mexicans and the passing of the pure blood inhabitants has made Pojoaque a Mexican settlement. Though much depleted in population since the original Spanish estimates of 6,000 people in eight pueblos, the Tewa villages are still flourishing, maintaining, despite an overlay of Catholicism and the veneer of white civilization, their ancient ceremonial, religious and social structure, many of their old methods of distinctive sedentary pueblo life with its dual organization into Winter and Summer

People, its communal adobe houses, its matrilineal descent, pottery-making, weaving and agriculture.

TEWKESBURY, a town of Gloucestershire, England, situated on the Warwickshire Avon near its junction with the Severn, about 121 mi. northwest of London. There are evidences of Roman and Saxon occupation. The abbey church, which was consecrated in 1125, is one of the finest examples in England of the Norman style, and is especially noted for its tombs and 14th century stained glass. It measures 300 ft. by 80 ft., and its most interesting features are the Norman tower, 132 ft. high, the western front, the Founder's Chapel, 1397, the Beauchamp Chantry, 1425, the tomb of Hugh le Despenser III (d. 1349), and the vault of the Duke of Clarence. An old town of half-timbered houses and narrow streets, Tewkesbury is the Nortonbury of Mrs. Craik's *John Halifax, Gentleman*. It was famed in Shakespeare's time for its mustard, but to-day its chief interests are bound up with milling and agricultural trades. Pop. 1921, 4,704; 1931, 4,352.

TEXARKANA, a city on the Texas and Arkansas boundary in Miller Co., Ark., and Bowie Co., Tex., situated 9 mi. from the Red River. Bus lines and four railroads serve the city. There also is an airport. The district produces cotton, corn and fruit. Gas and oil fields are in the region and the only diamond mine in North America is 55 mi. from here. In 1929 the various local manufactures in the entire city amounted to about \$6,000,000; the retail trade was valued at \$16,895,977. The Texarkana Junior College is located in the city. Texarkana was founded in 1873. Pop. in Ark., 1920, 8,257; 1930, 10,764; in Tex. and Ark. both, 1920, 19,737; 1930, 27,366.

TEXAS, one of the South Central States of the United States, popularly called the "Lone Star State." It is situated between 26° 51' and 36° 39' N. lat. and 93° 30' and 106° 30' W. long. On the north it is bounded by New Mexico and Oklahoma, separated in part from the latter state by the Red River; on the east it is bounded by Oklahoma, Arkansas and Louisiana, separated in part from the latter state by the Sabine River; on the southeast it is bounded by the Gulf of Mexico; on the southwest by Mexico from which it is separated by the Rio Grande River, and on the west by New Mexico.

Texas comprises an area of 265,896 sq. mi., inclusive of 3,498 sq. mi. of water surface. It is roughly triangular in shape with a square panhandle extending north. The maximum length of the state is 800 mi. from north to south and the maximum breadth is 750 mi. from east to west. In size Texas ranks first among the states of the Union.

Surface Features. Texas is a broad expanse of plains sloping to the southeast. Topographically it



TEXAS STATE SEAL

is divided unequally among the semi-arid Great Plains, the Gulf Coastal Plain, the Central Lowlands, and a small mountainous region in the extreme southwestern part. The latter is a section of the Mexican highlands extending from New Mexico to the north, southward into old Mexico, and consisting of two parallel series of short ranges with flat, arid basins between. The eastern line is made up of the Guadalupe, Davis, Ord and Santiago ranges, and the western belt of the Hueco, Quitman, Eagle and Vieja mountains. El Capital, 8,700 ft. high, in the Guadalupe range is the maximum elevation in the state. The mean altitude above sea level is 1,700 ft.

The Great Plains occupy a goodly portion of the state, beginning with the panhandle at the north and extending southward as far as Del Rio. They overlook the Central Lowlands on the east by an east-facing escarpment. At the north they are interrupted by the valley of the Canadian River, south of which they are known as the *Llano Estacado* or Staked Plains, and consist of an exceedingly flat surface almost untouched by erosion. The Llano Estacado, at about the 32nd parallel, begins to merge into the Edwards plateau which is slightly lower in altitude and relies for its flatness on a smooth limestone base rather than the porous sedimentary mantle. This plateau includes also the Stockton plateau west of the Pecos from which it is separated by the 1,000-ft. cañon of that river. North of the Stockton plateau is the Toyah basin, a continuation of the Pecos valley of New Mexico. Due to its limestone base, the Edwards plateau has an extensive development of underground water. It terminates at the south with the Balcones escarpment, extending from Austin where it is 300 ft. high, to Del Rio where it attains 1,000 ft.

The southeastern portion of the Edwards plateau wraps around a small denuded area covering Llano, Burnet, Mason, San Saba and Gillespie counties. This is called the central mining region. Just north of it may be seen a chain of mesas and buttes which constitute the Callahan Divide, the watershed between the Colorado and Brazos rivers.

North of this divide and west of the Llano Estacado is a section of Central Lowland, differing from the Great Plains by having a more rolling surface and a greater amount of rainfall.

The Gulf Coastal Plain occupies all that area south of the Balcones escarpment and east of an indistinct ridge extending northward from Austin. Just outside of this line is a belt of dark limestone soil known as the Black Prairie which is a rich agricultural region and in which the cities of Fort Worth, Dallas, Waco and San Antonio are situated. The remainder of the coastal plain is low, flat and generally treeless.

Texas is drained by the Colorado, Brazos, Neches, Sabine and Red rivers into the Gulf of Mexico. The state has 973 mi. of shoreline indented by several bays such as Galveston, Lavaca and Corpus Christi. There is a secondary outlying coast consisting of sandy barrier beaches between which and the mainland are long lagoons.

Climate. By reason of its extremely southerly position, close to the border of the tropical zone, and its great range in latitude, 800 miles, and altitude, 9,000 ft., Texas exhibits a considerably varied but generally warm climate. The mean annual temperature for the entire state is 66.2° F., ranging from 56.3° F., with an average of 35.3° F. for January and 76.8° F. for July, at Amarillo in the panhandle of the northwest, to 63.3° F., with an average of 45° F. for January and 81.1° F. for July, at El Paso in the extreme west, 69.6° F., with an average of 53.8° F. for January and 83.4° F. for July, at Galveston, on the coast, and 73.1° F., with an average of 59.8° F. for January and 83.6° F. for July, at Brownsville in the extreme south. During the period 1891-1930 the highest temperature recorded in Texas was 119° F. and the lowest, -23° F. The average annual precipitation is 31.1 in., but it decreases to a marked degree from east to west. At Galveston the yearly mean is 44.8 in.; at Fort Worth, 33.1 in.; at Brownsville, 27.4 in.; at Amarillo, 21 in.; at El Paso, 9.2 in. There are 341 days in the average growing season at Corpus Christi and Galveston; 246 days at Fort Worth and El Paso and 195 days at Amarillo.

Forests and Parks. More than 30,000,000 acres or approximately $\frac{1}{6}$ of the land area was originally forested. In a 1931 estimate forests cover 12,624,000 acres. This figure includes 750,000 acres of virgin forest and 8,524,000 acres of second-growth timber of commercial size. Long leaf, short leaf, and loblolly pines and bottom hardwoods, chiefly oak, red gum, tupelo, cottonwood, elm and hickory are the important trees. The principal forest belt is in the eastern part of the state. The long leaf pine predominates in the uplands of the coastal plain north of the Colorado River; the short leaf pine farther inland and particularly in the northeastern corner. Hardwoods are found in the alluvial fields of the numerous rivers which traverse this region and increase in proportion toward the west. On the hilly outskirts of the Edwards plateau immediately west of the pine belt and extending north and south across the state parallel to it are extensive cedar brake and post-oak regions covering approximately 12,000,000 acres. Some 3,000,000 acres of mesquite are scattered on the uplands of the eastern section of the prairie region. Texas has taken important steps to conserve her forests. Two forest-tree nurseries grow seedlings for sale at cost to land owners and the state also cooperates with the Federal Government under the Clarke-McNary Law and receives appropriations for fire protection and forest planting stock. Three state forests totaling 5,694 acres have been established in Newton, Montgomery and Cherokee counties and form the nucleus of a proposed 100,000-acre system in the commercial timber belt. Twenty-four state parks have been established ranging in area from 10 acres to a 3,000-acre tract in the Davis Mountains. The recreational development of these parks has been slow due to insufficient appropriations. State game preserves cover over 2,000,000 acres. No hunting is per-

mitted and the game from these reservations is stocking the surrounding regions. Quail, prairie chicken, turkey and deer are greatly on the increase.

Minerals and Mining. Texas owes its leading position in mineral production to its extensive, widely distributed and exceedingly rich oil fields. Petroleum production became important with the discovery in 1901 of the Spindle Top field near Beaumont. In 1929 the value of petroleum and allied products constituted 85% of the total mineral output of the state. Large areas are underlaid with bituminous coal and lignite, as yet but little developed. With the exhaustion of the Louisiana mines in 1924 Texas became the chief sulphur-producing state.

With mineral productions in 1929 amounting to \$495,819,500, or 9.6% of the total United States output, Texas stood fourth among the states, ranking first in sulphur, second in petroleum, third in natural gas, natural gasoline and asphalt, fourth in mercury and gypsum, ninth in silver, and tenth in limestone.

The outstanding products were petroleum, 296,876,000 bbls., valued at \$322,520,000; natural gas, 464,928,000 M cu. ft., \$67,474,000; sulphur, 2,435,483 tons, \$33,811,000; and natural gasoline, 419,485,000 gals., \$26,561,000. Other important items of output in order of value were cement, 7,083,572 bbls., \$11,805,779; clay products, \$6,010,179; sand and gravel, 9,409,295 tons, \$5,765,943; gypsum, 520,519 tons, \$3,440,287; and stone, except basalt, 3,647,150 tons, \$2,948,865.

During 1929 159 mines and quarries gave employment to 7,379 persons who received \$9,805,365 in salaries and wages.

Soil. Although Texas embraces an area more than four times as large as that of the average state of the Union, it does not exhibit a correspondingly great diversity of soils. The extensive Black Prairie belt in eastern Texas is one of the richest agricultural districts of the state. Its highly fertile soil is derived primarily from the decomposition of the underlying limestones. On the west the Black Prairie is flanked with a large area of somewhat similar but much thinner soils. At the south these border on tracts of still less fertile granitic soils. In the high plains of the northwest there are red clay soils of slight nitrogenous content, varied by rich black soils and thin clayey ones intermixed. In general the soils of the Edwards plateau and the Staked Plain regions of western Texas are poor and thin.

Agriculture. Texas outranks all other states in value of crops produced, largely because of its pre-eminence in growing cotton.

In 1930 124,707,130 ac. or 74.3% of the entire land area was in farms, 495,489 in number, with an average size per farm of 251.7 ac. and an average value per acre of \$28.85. Of the farm area 34,766,166 ac. or 28% was crop land; 86,942,437 ac. or 70%, pasture land; and 1,240,472 ac. or 1%, woodland. The total value of farm property was \$4,234,315,699, of which \$3,597,406,986 was represented by land and buildings; \$182,186,809, by implements and machinery; and \$454,721,904, by domestic animals.

According to the Census of 1930 Texas produced in 1929 field crops to the value of \$617,863,792, ranking first among the states. It stood first in cotton and cottonseed, third in rice, fifth in wheat and tenth in corn; it ranked first in onions, second in watermelons, third in cabbages, fourth in tomatoes, ninth in sweet potatoes and fifth in all vegetables harvested for sale. In fruit production Texas stood first in pecans, second in figs and blackberries, third in grapefruit and oranges, fourth in peaches, fifth in plums and prunes and seventh in pears.

The chief crop was cotton, 3,793,392 bales grown on 16,813,568 ac. and valued at \$303,471,360, together with cottonseed, 1,762,736 tons, \$56,407,552. Other important crops were grains, \$142,972,996; hay and forage, 650,992 tons, \$41,132,272; vegetables, \$34,833,544, and fruits and nuts, \$8,867,807. The leading grains were corn, 66,251,026 bu. produced from 4,076,206 ac.; wheat, 44,077,764 bu., from 2,969,511 ac., and oats, 27,260,261 bu., from 1,148,110 ac. Other grain crops included rice, 5,158,544 bu., and barley, 3,743,677 bu.

Among the vegetables were tomatoes \$4,166,253, potatoes \$4,159,824, sweet potatoes \$3,562,402, onions \$2,454,997, watermelons \$1,808,119, cabbages \$1,376,134, spinach \$1,064,490 and beans \$589,719. The chief orchard fruits were peaches 2,073,235 bu., pears 509,710 bu., plums and prunes 293,159 bu. and apples 188,134 bu. Other important fruit and nut crops were grapefruit 997,551 boxes, oranges 316,245 boxes, figs, 8,425,468 lbs., grapes 3,908,050 lbs., blackberries 5,474,598 qts., strawberries 3,089,948 qts. and pecans 9,588,376 lbs.

Farm products sold by cooperative marketing rose from \$4,437,036 in 1919 to \$14,459,145 in 1929. Farm machinery and equipment in 1930 included 300,176 automobiles, 52,580 motor trucks, 37,348 tractors, 5,351 electric motors and 18,974 stationary gas engines.

Irrigation. Although established before the Civil War, irrigation was but slightly developed before 1890. Since that date expansion has been substantial and sometimes rapid. In the Census of 1930 operations were separately reported for 46 of the 254 counties in the state, which ranked sixth in amount invested in irrigation enterprises and seventh in total value of irrigated lands. These are devoted chiefly to the production of market vegetables, rice and general field crops, as cotton, cereals and alfalfa. The Rio Grande and tributaries furnish water for two-thirds of the irrigated acreage. Various smaller rivers in southeastern Texas supply the rice-growing districts. The Red River serves various enterprises.

A unique development is found in Cameron and Hidalgo counties bordering the Rio Grande in the extreme south. These two counties contain almost one-half of all the irrigated land in Texas. Besides producing 32,800 bales of cotton, 683,000 bu. of potatoes and 704,000 bu. of corn, this district in 1929 grew market vegetables valued at \$3,186,000, or 22% of the total for the state.

The total number of irrigated farms in 1930 was

10,861, with an aggregate area of 1,899,240 ac., of which 798,917 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$180,145,521, or an average of \$94.85 per ac. The total investment in irrigation enterprises to 1930 was \$49,022,164 and the average cost of maintenance and operation for 1929 was \$4.74 per ac.

Animal Industry. Cattle-raising, both for beef and milk production, and sheep-raising are preeminent livestock interests. According to the Census of 1930 the rank of Texas among the states was first in cattle, mules, sheep and goats, fourth in horses and fifth in milk cows; it stood first in wool and mohair shorn, fourth in chickens raised, in chicken eggs produced, and in yield of honey, and tenth in milk production. The state ranked second in total value, \$454,721,904, of domestic animals. Among these were 6,602,702 cattle reported from 359,097 farms or 78% of all farms in the state and valued at \$267,019,133; mules, 1,040,106 in number valued at \$69,694,121; horses, 762,042, \$32,245,457; sheep, 7,021,334, \$42,476,780; swine, 1,561,461, \$13,935,456; goats, 3,142,321, \$13,491,578, and asses and burros, 6,638, \$110,662.

Of the cows on farms 2,156,309 were kept mainly for beef production and 1,241,174 mainly for milk production. In 1929, 412,707,814 gals. of milk were produced; the butter churned on farms amounted to 58,015,512 lbs. The total value of dairy products sold was \$39,660,405. The value of all poultry raised was \$33,129,814. The number and value of the chief kinds were chickens, 36,275,063, \$24,295,056; turkeys, 3,782,912, \$8,645,685; geese, 127,115, \$131,720, and ducks, 85,984, \$57,353. The chickens sold, 10,706,967 in number, were valued at \$7,720,955. Of 154,354,737 doz. chicken eggs produced, valued at \$38,616,333, 89,465,537 doz., with a value of \$22,369,681, were marketed. The sheep industry yielded 38,523,669 lbs. of wool valued at \$10,945,037. From goats were clipped mohair and kid hair to the value of \$5,691,059. Honey, amounting to 4,726,363 lbs. valued at \$555,028, was produced from 234,053 hives.

Fisheries. The commercial fish catch of Texas for 1930 amounted to 18,432,000 lbs., valued at \$962,000, most of the fish coming from the Gulf of Mexico, and a few from the Mississippi River. Principal species taken include croaker, mullet, snapper, buffalo fish, carp, catfish, drum, grouper and menhaden. In 1930, the state issued 32,111 fishing licenses and operated 7 fish hatcheries, employing 35 men at a cost of \$106,000. The output for the year was 873,000 bass and 347,250 other game fish. During 1930, the U.S. Bureau of Fisheries distributed 224,784 large-mouth bass, 382,605 sunfish and 115,000 other game fish in state waters.

Transportation. The state carries on an extensive foreign and coastwise trade by water routes. The oldest and most important port on the Gulf coast, with excellent harbor and terminal facilities, is Galveston. Although Houston is 60 mi. from the Gulf of Mexico, the Houston ship canal affords transpor-

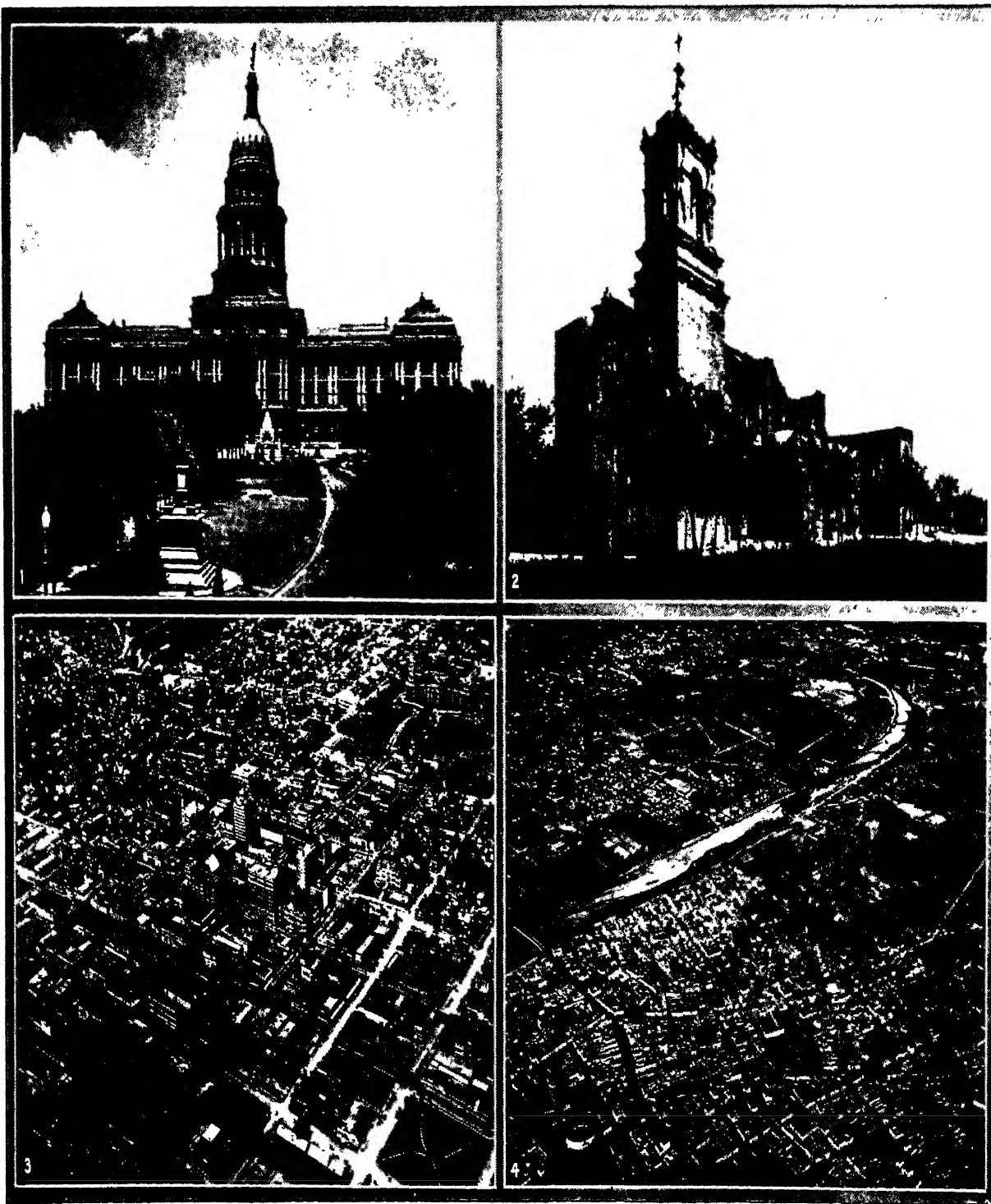
tation to ocean-going vessels, encouraging the development of the port. Corpus Christi, with improved harbor facilities, is the principal port for southern Texas. A number of the rivers, navigable only for boats of light draught, are of local commercial importance. Texas has more steam railway mileage than any other state in the Union. The principal systems include the Southern Pacific, the Santa Fé, the Missouri, Kansas and Texas, the Texas and Pacific and the Colorado and Southern. These roads with their branches controlled most of the total mileage of 16,891 in 1930.

The highway system has shown consistent improvement and expansion. Including the principal through routes, there were 213,882 mi. of highways on Jan. 1, 1930, of which 26,012 mi. were surfaced roads and 10,896 mi. improved state highways. During 1929, highway expenditures were \$56,680,701. Of this amount, \$33,680,701 was paid by the state and \$23,000,000 by county and local governments. Gasoline consumption during 1930 aggregated 806,505,000 gals. The state gasoline tax that year produced an income of \$29,527,098 as against \$5,226,886 in 1926. Motor vehicle registrations were 1,365,896 in 1930 compared with 975,083 in 1925. The rapid growth of transportation by truck is indicated by registrations, which rose from 88,721 in 1925 to 206,757 in 1930, or about 134%. During the same period the number of buses in operation for the transportation of passengers increased from 1,137 to 1,847.

Manufactures. Texas has developed, mostly since 1900, many important manufacturing industries based chiefly on the utilization of its rich mineral, forest and agricultural resources. Since 1905 expansion in manufactures has been very rapid. The increase in value of products during the 25-year period 1905-1929 exceeded 850%.

According to the Census of 1930 Texas with manufactures for 1929 valued at \$1,450,246,431 stood thirteenth among the states. Its 5,198 establishments gave employment to 21,645 officers and employees, who received \$49,904,900 in salaries, and to 134,498 wage earners, who were paid \$151,827,257 in wages. These factories used a total of 822,860 horse power, expended \$35,131,834 for fuel and power, and \$954,807,794 for material and supplies, and added by the process of manufacture \$460,306,803 to the value of their output.

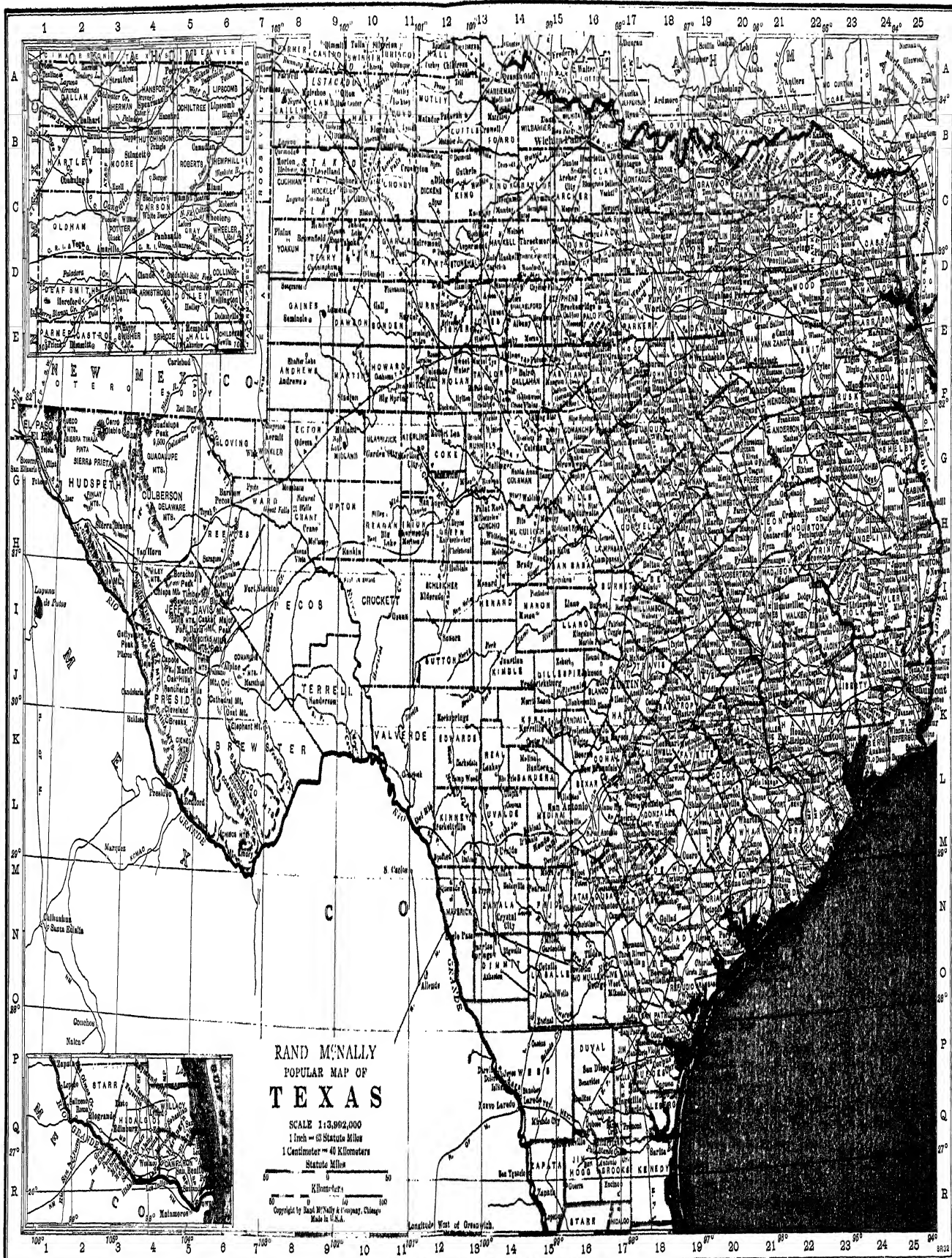
In this output there were 99 separately enumerated groups of manufactures. The state stood first in petroleum refining, cottonseed oil and wood preserving, and second in manufactured ice and rice cleaning. Texas ranked fifth in flour, sixth in steam railway carshop construction, seventh in beverages, eighth in coffee roasting, ninth in lumber and the publishing of newspapers and periodicals, and tenth in bread and bakery products. The outstanding industry was petroleum refining with products valued at \$519,005,136 or 36% of the manufactures of the state. Other important items in order of value were cottonseed oil, \$95,351,198; meat packing, \$88,273,991; flour, \$51,-



1, BOOKE PHOTOS, COURTESY CHAMBER OF COMMERCE, AUSTIN; 2, HARVEY PATTESON PHOTO, SAN ANTONIO; 3, COURTESY EL PASO GATEWAY CLUB

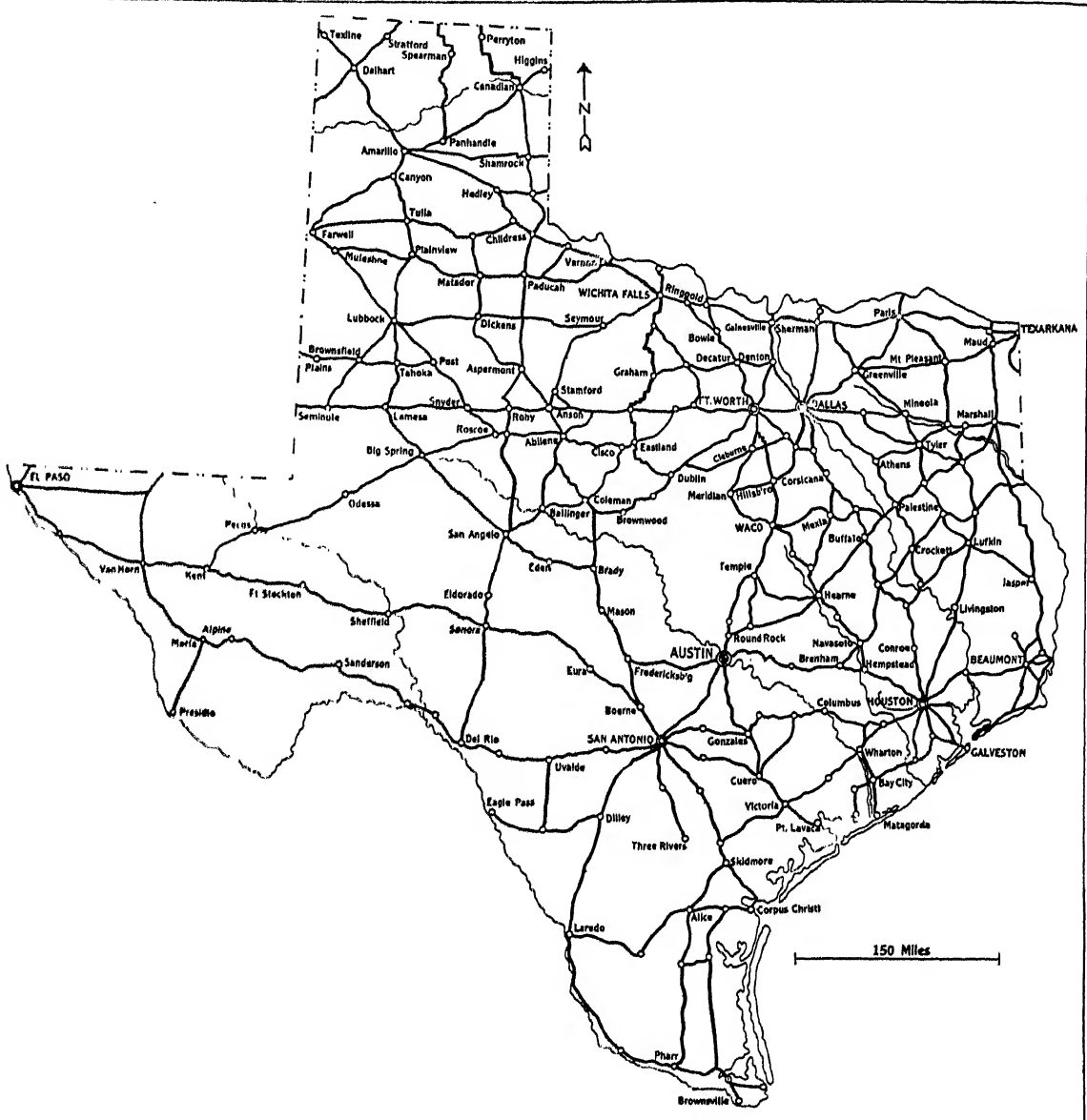
BUILDINGS AND CITIES OF TEXAS

1. The State Capitol at Austin, built entirely of Texas red granite. 2. A survival of the Spanish occupation of Texas territory, the beautiful Franciscan mission of San José de Aguayo near San Antonio, dating from 1720. 3. Air view of Austin, with the Capitol in the right foreground. 4. El Paso, Texas, and Juarez, Mexico, with the Rio Grande between. The bridge at the left carries traffic only into Mexico, while another carries traffic only into the United States.



378,284; foundry and machine shop products, \$49,180,837; lumber, \$44,506,136; steam railway carshop construction, \$43,008,426; printing and publishing of newspapers and periodicals, \$38,423,907; bread, \$35,881,047; wood preserving, \$21,622,654; manufactured

States and was exceeded in only seven other states. The wholesalers gave full-time employment to 58,989 men and women, whose annual salaries and wages aggregated \$96,206,700. The chief wholesaling centers are Dallas, which reported sales of \$735,807,682,



TEXAS STATE ROADS

ice, \$19,192,105; cotton goods, \$18,862,217, and coffee roasting, \$16,807,165.

The leading manufacturing cities with value of output were Houston, \$144,752,821; Dallas, \$142,529,820; Fort Worth, \$113,582,214, and San Antonio, \$52,884,256.

Commerce. According to the Census of 1930, there were in 1929 9,606 wholesaling establishments in Texas, with total sales of \$2,804,509,116. This volume represented 4.04% of the total for the United

States and was exceeded in only seven other states. The wholesalers gave full-time employment to 58,989 men and women, whose annual salaries and wages aggregated \$96,206,700. The chief wholesaling centers are Dallas, which reported sales of \$735,807,682,

and Houston, with \$526,300,075, San Antonio, Fort Worth, Galveston, Waco, Amarillo and El Paso are also important.

The total sales of the 67,258 retail stores amounted to \$2,074,164,554. Sales per store averaged \$30,839; sales per capita were \$356.10.

The port of Galveston handled 5,471,713 tons of water-borne commerce, with a value of \$659,816,902. The Houston Ship Channel handled an additional 13,917,953 tons, with a value of \$564,842,734. Cotton,

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive	15,292	\$494,865,034	23.86
General Mdse.	8,709	465,452,969	22.44
Food	18,257	377,631,440	18.21
Lumber & Bldg.	3,117	172,025,580	8.31
Apparel	2,825	110,424,614	5.31
Furn. & Household ..	2,140	92,533,400	4.46
All other stores	16,918	361,231,517	17.41

Total, all stores ... 67,258 \$2,074,164,554 100.00

sulphur, oil and gasoline, wheat and copper were the largest items.

Finance and Banking. Since 1920 the tremendous increase in oil output and the growing importance of the cotton industry has greatly increased property values in Texas. In 1929, the assessed value of all taxable property was \$3,975,409,226. The state's total bonded debt was only \$4,002,200. Total state revenues in 1928 were \$93,140,031; total disbursements, \$84,312,424. The chief sources of income were property taxes, \$28,830,000, and licenses, \$41,850,000. This item included taxes on corporations, insurance companies, motor vehicles and gasoline, \$19,211,576. The principal payments were for highways, \$28,318,305, education, \$23,803,923, and permanent improvements, \$2,640,157.

There were 1,302 banks in Texas in 1930. Of these, 551 were national banks, 682 state banks and trust companies and 69 private banks. Their total capitalization was \$124,870,449 in 1930; their surplus and undivided profits, \$91,105,000. Total resources were \$1,362,782,000, with loans and discounts aggregating \$738,249,000. Demand and time deposits totaled \$945,881,000. Per capita savings deposits were \$36.93; per capita demand and time deposits, \$161.69. The total savings of \$216,058,000 were owned by 400,646 depositors. National bank circulation aggregated \$41,485,000.

Government. The legislative body of Texas consists of a Senate composed of 31 members and a House of Representatives of 150 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions of unlimited length. The chief executive is the governor elected for terms of two years at a salary of \$4,000 per year. Other executive officers are the lieutenant governor, secretary of state, comptroller of public accounts, treasurer, commissioner of the general land office and attorney-general. Judicial power is vested in a supreme court, courts of civil appeals, a court of criminal appeals, district courts, county courts and commissioner courts. The supreme court consists of three judges elected for terms of six years at salaries of \$5,000 per annum.

Social Welfare Institutions. There is a girls' training school at Gainesville and a juvenile training school at Gatesville. At Austin are schools for the white deaf and blind, an institute for the colored deaf, dumb and blind, a school for feeble-minded, the Texas Confederate Home and the Confederate Women's Home. There is an orphans' home at Corsi-

cana and a home for dependent and neglected children at Waco. Hospitals for the insane are at Austin, Rusk, Terrell, Wichita Falls and San Antonio. An epileptic hospital is located at Abilene and a tuberculosis sanatorium at Carlsbad. Convict farms are maintained at Hobby, Perry Landing, Sandy Point, Weldon, Midway, Richmond, Sugarland, Otey, Snipe and two at Huntsville, which is also the site of the penitentiary.

Education. The first schools were French and Spanish mission schools maintained largely for the education and conversion of Indians. A public school for white children was conducted in El Paso in 1806. The Mexican government attempted to establish a public school system in 1829, but the results were far from satisfactory. After Texas became a state, a school was established at San Antonio in 1854. Separate schools are maintained for Negroes. In 1928 there were 11,930 public school buildings, with 1,016,464 pupils in the public kindergartens and elementary schools, and 217,594 pupils in the public secondary schools. School attendance is compulsory for children 8 to 14 years for 100 days annually.

The number of persons from 5 to 20 years of age attending school in 1930 was 1,233,956, or 61.9% of the population within the ages specified, as compared with 980,469, or 57.7%, in 1920. The number of persons 10 years and over, unable to read and write, in 1930, was 308,121, or 6.8%, as compared with 295,844, or 8.3%, in 1920.

The principal state supported institutions of higher learning are the University of Texas at Austin, the Agricultural and Mechanical College at College Station, the College of Industrial Arts at Denton, the John Tarleton Agricultural College at Stephenville, Texas Technological College at Lubbock, eight teachers' colleges, and, for Negroes, the Normal and Industrial College at Prairie View. The privately controlled institutions include Baylor University at Waco, Baylor College at Belton, Texas Christian University at Fort Worth, Southern Methodist University at Dallas, and for Negroes, Bishop College and Wiley College, both at Marshall. The Texas Library and Historical Commission has its headquarters in the State Library at Austin.

Population. In 1930 Texas ranked fifth among the states with a population of 5,824,715 or an average of 22.2 per sq. mi., an increase of 1,161,487 or 24.9% over 1920. The population rose from 212,592 in 1850 to 2,235,527 in 1890, 3,048,710 in 1900, 3,896,542 in 1910 and 4,663,228 in 1920. In 1930 there were 4,283,491 or 73.5% whites, 854,964 or 14.7% Negroes, and 683,681 or 11.7% Mexicans, an increase from 1920 of 9.3% whites and 15.3% Negroes. No separation of statistics for Mexicans was made in the census of 1920. Of the whites, 4,185,095 were native-born, and 98,396 foreign-born. The rural population was 3,435,367 or 59.0% of the total, an increase of 284,828 or 9.0% from 1920; the urban population was 2,389,348 or 41.0% of the total, an increase of 876,659 or 58.0% since 1920. There were in 1930

five cities of 100,000 and upwards: Houston, 292,352; Dallas, 260,475; San Antonio, 231,542; Fort Worth, 163,447; El Paso, 102,421.

Occupations. In 1930 2,206,767 persons, or 37.9% of the population, were gainful workers 10 years old or older; 80.9% of these were males and 19.1% were females; 69.1% were native white; 2.5% foreign-born white; 17.7% Negro, and 10.8% other races. Among the principal occupations, with number of workers, were farmers, 487,197, and farm wage workers, 199,080; servants, 17,086 men and 70,519 women; salespersons, 63,707 men and 23,175 women; retail dealers, 77,866; clerks, 44,119 men and 18,892 women; factory operatives, 41,466 men and 15,407 women; factory laborers, 54,535; school teachers, 9,756 men, and 39,695 women; carpenters, 38,137; chauffeurs, 34,469; laundresses, 33,021; bookkeepers and cashiers, 15,551 men and 14,020 women; stenographers, 1,725 men and 23,013 women; steam railroad laborers, 23,964, and oil well operatives, 23,372.

HISTORY

Cabeza De Vaca and three other survivors of the Narvaez expedition of 1528 wandered through Texas. The expeditions of Marcos de Niza and of Coronado in the next decade were first of a series of official, usually elaborate, incursions into Texas in search of legendary riches. Spanish prospectors and traders occasionally traversed the state. Ísleta, a pueblo near El Paso, was the first permanent settlement, 1682. LA SALLE's accidental, and ill-fated, arrival in Texas was sufficient to arouse Spanish activity; several Franciscan missions and military posts, or presidios, notably at Nacogdoches, San Antonio and Goliad, were established within the next few years. In 1727 the province of Tejas was created, with vaguely defined boundaries. Colonists, except at San Antonio and in smaller numbers elsewhere, were not sent to supplement the European population of soldiers and priests. Louisiana having become United States territory, immigration began when Spanish Catholics of that district were encouraged to enter Texas. Spanish officials were loosening the traditional bars against alien immigration before 1821, when Mexico gained her independence. The new republic, while insisting that only immigrants of Roman Catholic faith were desired, permitted American settlers to enter under the auspices of certain grantees (*impresarios*). Stephen F. Austin, to whom was confirmed the grant issued his pioneering father, Moses Austin, established the first permanent Anglo-American settlement at San Felipe de Austin, 1821. The *impresario*, Benjamin Edwards, motivator of the FREDONIAN WAR, represented a more radical, less able element; but the weight of nearly 30,000 Anglo-Americans in 1836 in a province containing a few scant hundreds of Mexicans was a more potent factor than personal leadership in the movement for an independent Texas. After a short war distinguished by the heroic defense of the ALAMO and the decisive victory of SAN JACINTO, the Republic of Texas was launched. On Mar. 17,

1836, 15 days after a convention at Washington on the Brazos had adopted a declaration of independence, a constitution was adopted; in September SAM HOUSTON was elected to succeed David G. Burnet as provisional president. The republic was recognized by the United States, England, France, Holland, and Belgium, and as a potentially great cotton-producing region, was an object of international intrigues, none of which happily reached fruition. Austin succeeded Houston as the capital in 1839. A burdensome public debt, the incessant danger of Mexican invasion, and sentimental reasons combined to make annexation to the United States desirable. A leading issue in United States politics after 1836, admission was effected by a joint resolution of Congress in March, 1845, and formally completed on Dec. 29. The Rio Grande was fixed as the boundary in the treaty closing the MEXICAN WAR, 1848. Texas received its present limits when certain lands were sold to the Federal Government in 1850 (*see OMNIBUS BILL*). A slave state from the first, the opposition of Gov. Houston and of the German settlements was overridden as Texas joined the Confederacy. The legislative relics of a lingering, malodorous "reconstruction era" were eradicated, when the present constitution was adopted in 1876. Expansion in cotton production, livestock, ranching, wheat growing and oil mining added new chapters to a brilliant history. The Democratic party, which regained control in 1874, enjoyed an uninterrupted dominance until 1928, when Hoover received the state's electoral votes. In 1932, with Franklin D. Roosevelt and John N. Garner as candidates for the Presidency and Vice-Presidency, respectively, the Democrats carried Texas. Mrs. Miriam A. Ferguson, Democrat, defeated Orville Bulington, Republican, in the gubernatorial election.

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TEXAS, AGRICULTURAL AND MECHANICAL COLLEGE OF, a land-grant college for men at College Station, Tex. It was formally opened in 1876, and has schools of agriculture, engineering, arts and sciences, veterinary medicine, vocational teaching, and a graduate school. There are also agricultural and engineering experiment stations here, a library containing over 25,500 volumes and a palaeontological museum. In 1930 the total value of grounds, buildings and equipment was \$7,836,322. The total number of students enrolled in 1931 was 2,236. The teaching staff numbered 191, headed by President T. O. Walton.

TEXAS, UNIVERSITY OF, at Austin, Tex., a coeducational state institution, organized in 1881. The university includes the College of Arts and Sciences, the departments of Law, Engineering, Medicine, Education, Business Administration and Extension, the Graduate and Summer schools, and the Bureau of Economic Geology and Technology. The medical branch is located at Galveston, and the College of Mines and Metallurgy at El Paso. Endowed and maintained by

TEXAS CHRISTIAN UNIVERSITY—TEXTILE FABRICS

legislative grants of land totaling 2,000,000 acres, on part of which oil has been discovered, the university had productive funds in 1931 amounting to \$28,152,751. The library contained 381,914 volumes. In 1931-32 there was a student enrollment of 5,328, and a faculty of 422, headed by Pres. HARRY YANDELL BENEDICT.

TEXAS CHRISTIAN UNIVERSITY, at Fort Worth, Tex., founded by Addison and Randolph Clark at Thorp Springs, Tex., in 1873, is coeducational and non-sectarian although affiliated with the Church of Disciples of Christ. The institution was moved to Waco in 1895, and to Ft. Worth in 1910. In 1902 the name was changed from Add-Rann Christian College to the present title. It had an endowment in 1931 of \$3,051,692. The library contained 55,000 volumes. In 1931-32 there were 1,392 students, and a faculty of 89, headed by Pres. Edward M. Waits.

TEXAS CITY, a seaport city in Galveston Co., southeastern Texas. It is situated on Galveston Bay, 38 mi. southeast of Houston and is served by three railroads. The town has a deep water front. The traffic of the harbor in 1930 amounted to \$55,019,414. Handling cotton and oil for shipping, sugar and oil refining and canning are the local industries. Texas City is a summer resort and has deep sea fisheries. Pop. 1920, 2,509; 1930, 3,534.

TEXAS FEVER, an infectious blood disease of cattle due to the presence of a protozoan parasite which is transmitted by cattle ticks. Cattle raised in an infected district become immune to Texas fever, but carry the organism in their blood, and if new cattle are introduced or immune cattle moved to uninfected districts, the healthy animals may become infected by ticks from the carrier animals. The United States distribution of Texas fever corresponds to the distribution of the cattle tick (*Boophilus annulatus*). This tick carries the parasite (*Piroplasma bigeminum*) found in the blood of the animal. A postmortem shows the spleen much enlarged, the liver affected, enlarged and congested, the blood vessels distended and the cells in a state of fatty degeneration. Immunization can be carried on by inoculating healthy animals with the blood of immune cattle. Prevention by elimination of the tick is the only way to check Texas fever.

TEXAS FLY, a European fly (*Haematobia irritans*) accidentally introduced in America about 1887 and now found from Canada to Mexico. Formerly it was abundant in the northeastern states but is now rarely troublesome. The adults, about the size of house flies but more slender, suck blood from the flanks, bellies and backs of cattle. When at rest they congregate around the bases of the horns, hence another popular name horn fly. From this position the cattle cannot dislodge them. The larvæ are maggots which live in fresh, moist manure. They may be destroyed by daily spreading the manure to dry.

TEXAS STATE COLLEGE FOR WOMEN, known also as College of Industrial Arts, an insti-

tution at Denton, Tex., was chartered in 1901. It was opened as an educational institution which would provide for women training similar to that offered men at the Agricultural and Mechanical College at College Station. It comprises schools of Liberal Arts, Fine and Applied Art, Industrial Arts and Science, Home Economics, and Education. The grounds and buildings were valued in 1931 at \$1,775,569. The library contained 33,000 volumes. In 1930-31 there were 1,736 students, and a faculty of 130, headed by Pres. Louis H. Hubbard.

TEXAS TECHNOLOGICAL COLLEGE, an institution for men and women founded at Lubbock, Tex., in 1925. It is controlled and in large part supported by the state and is non-sectarian. The college gives instruction in arts and sciences, agriculture, home economics and engineering, and maintains a summer school and extension courses. The grounds and buildings were valued in 1931 at \$2,868,073. The library contained 14,623 volumes. In 1931-32 there were 1,821 students and a faculty of 133 headed by Pres. PAUL W. HORN.

TEXTILE DESIGNING deals with the structure and decoration of fabrics. It concerns itself with both utility and beauty in order to serve and adorn the person of mankind.

Some fabrics derive their characteristics from yarn structure alone. Voiles, for example, owe their harsh feel and wrinkle-resisting quality to the smooth hard-twisted yarns from which they are made. Likewise the crinkled effect in crepe is obtained by alternately pairing threads of righthand and threads of lefthand, twist in a plain woven cloth.

Numerous fabrics owe their characteristics to the manner in which the threads are spaced. Thus a plain fabric with twice as many vertical as horizontal threads in a unit of length presents fine transverse ribs and the fabric is called poplin or broadcloth.

Decorative fabrics include dobby patterns and jacquards. The design in dobby patterns may consist of dots, stripes, checks, diamonds, diagonals, and similar figures developed by combining weaves or by utilizing both weave and color differences. Jacquard cloths such as table damasks may contain large floral patterns with both figure and ground in solid white. In this case the patterns are developed by using contrasting weaves in the figured areas and the surrounding or ground areas.

W. E. S.

TEXTILE FABRICS. The field embraced under the title "textile fabrics" is an immense one, infinitely greater than one would casually suppose. A very wide range of raw materials enters into these productions. The most important of these are Wool, Cotton, Silk, artificial silk (now generally known as rayon) (see FIBERS, SYNTHETIC), Flax (Linen), Jute, Mohair, alpaca, llama hair, Camel Hair, and, in a lesser degree, Ramie, cocoanut fiber, Hemp, pineapple fiber, tinsel, asbestos, goat hair, cattle hair, horse hair, rabbit hair, vicuña, and many others, both of animal and vegetable origin, which are used, more or less, in different lands, and for different purposes.

The term, "wool," is applied to the hair of the sheep, while that of other animals is classified as "hair." In all of these different materials, there are endless grades and qualities.

Omitting such products as thread, twines, fishing nets, cordage, laces, braids, tassels, etc., the great mass of the fabrications will be either woven or knitted. Also, materials of different kinds will be combined in a wide variety of admixtures in the fabrics made, to secure the desired results in the weight, texture, handle, appearance, and cost, etc., of the merchandise.

Among the different lines of manufacture, are dress goods; cloakings; men's wear; cotton fabrics of endless kinds, and for a myriad of uses—mostly of simple construction; dress silks; tie silks; millinery silks; linings; ribbons; veilings; nettings; velvets; plushes; terry cloths; corset cloths; imitation furs; RUGS AND CARPETS of varied constructions; mats and mattings; shawls; scarfs; upholstery materials; draperies; fabrics for mechanical uses, such as beltings; filter-press cloths, etc.; canvas for sails, tenting, military purposes, and what not; bagging, felts; linens of all kinds, such as table linens, towels, dress linens, ducks, shirtings, etc., in fact, the list might be prolonged indefinitely.

The knitted fabrics (*see* KNITTING) are principally used for hosiery, underwear, sweaters, women's outer garments, men's overcoatings, etc.

One great branch of the industry is the production of reworked wool, that is, the conversion of rags, tailors' clips, waste yarns, and waste materials of all kinds, into their original fibrous form, and thus producing material, shorter, of course, in length, and inferior in character to what it originally was, but suitable for spinning up afresh into yarns for manufacturing purposes, or for mixing in with new material. This recovered fiber is generally designated as "shoddy," although, here again, there are numerous grades and qualities, some of the material being extremely good.

Among the yarns spun from these many kinds of raw materials, there are a variety of sizes, from very fine to very coarse, these being modified by the amount of twist (*see* TWISTING) given to them. Whether in the thread form, or in the fabric these may be dyed into innumerable colors. Many fancy yarns are also produced, showing special characteristics of lumps, knots, loops, flakes, etc., which are used as effect threads in the ornamentation of goods. *See also* SPINNING.

In woven goods, there are two main elements in the structure, namely, the "warp," and the "filling," also known as "weft," or "woof." The warp threads run lengthwise throughout the cloth, while the filling threads are woven in crosswise, one after the other, as the shuttle, carrying a bobbin of filling yarn, crosses the loom, back and forth, as the weaving proceeds.

The movement of the warp threads is controlled by "harnesses." These are a series of frames, from two upwards, which surround the warp, and between the lower and upper shafts of these frames are arranged a series of threads, or wires, with eyes in the center,

known as "heddles," or "healds." These frames are hung in the loom, and, by various mechanical devices, they are made to rise or fall in a prearranged order. The warp threads, generally many thousands, are wound up on a roller known as the "warp beam," which is placed at the back of the loom, and held at proper tension by suitable devices. These warp threads are drawn, individually and in regular order, through the eyes of the heddles. They then pass through the "reed," and come forward to the front of the loom where they are secured to the leader cloth—a stout piece of canvas which is attached to the "cloth beam." The reed is a steel comb, several inches high, closed at the top and the bottom, and secured in a moving part of the loom known as the "lay," or "lathe." The wires, or "dents," of the reed are thin flattened pieces of steel, and the warp threads pass through the splits between the wires, being arranged according to the requirements of the cloth, as, two, three, four, etc., in each split. The reed keeps the threads in proper alignment between the warp beam and the weaving cloth, and acts as a support, or guide for the shuttle as it crosses the loom. It keeps the warp threads evenly spaced, and, as it moves forward, it "beats up," that is, pushes the filling thread into the weaving cloth. At each side of the reed, and moving backwards and forwards with it, is a receptacle for holding the shuttle, known as the "shuttle box." In a plain loom there is only one shuttle box on each side. In a Box Loom, there are extra boxes, so that more than one shuttle can be used. Some looms are made with two boxes on one side, and one on the other, known as 2 x 1 box looms, or they may be 2 x 2, or 4 x 1 or 4 x 4, etc. In the latter case, as many as seven different shuttles, each carrying a different kind or color of material, may be used, for there must always be at least one empty box into which the next shuttle to cross can enter.

The "weave" of a fabric is the particular way in which the interlacing of warp and filling occurs, and, as the harnesses are caused to rise up or stay down, so will the warp threads be separated into two groups, some down, and some up. This opening between the threads is known as the "shed." When the shed is opened, the shuttle crosses, leaving a filling thread behind it. Then the reed pushes forward and beats that pick into the cloth. Meantime, the position of the harnesses is changed, and, when the reed goes back and a new shed is formed, the warp threads are in a different position or arrangement. Then, when the shuttle comes back, another and different interlacing occurs. Meantime, a mechanism known as the "take-up motion" is pulling the weaving cloth forward, and this, in turn, is being slowly and regularly wound up on the "cloth beam." The number of different positions in which the warp threads can interlace is governed by the number of harnesses, so that in the weaving, for instance, of an eight-harness satin, there cannot be more than eight different interlacing arrangements of the threads. The great bulk of the fabrics on the market will be woven

within the limits of eight harnesses, but, for the more complex weaves, considerably more may be employed, the number not usually exceeding 27, although as many as 36, or even 48, may occasionally be used.

Therefore, the three primary operations of weaving are: first, the "shedding," that is, the separating of the warp threads; second, the "picking," that is, the driving of the shuttle across the loom by means of the "picking stick"; and, third, the "beating-up" of the filling threads into the cloth by the reed. There are also the "warp let-off motion," and the "cloth take-up motion." Of course, there are many other attachments and mechanisms in a loom, which cannot be gone into here. With the multitude of materials of all kinds, sizes, colors, twists, etc., and with the endless ways in which they can be interlaced, it is apparent that an infinity of different fabrications can be produced.

When figured patterns are to be made, in which the number of different positions of the threads in the cloth is in excess of what it is possible to make in a harness loom, a "Jacquard loom" is used. In this, instead of the warp threads being controlled by the ordinary harnesses, the "Jacquard harness" is employed, which consists of a multitude of individual harness threads connected with heddles, one for each warp thread, and which permits of an infinitely greater scope in the making of patterns, and thus large figured designs may be made.

In all textile fabrication, there are three basic weaves—the *plain*, the *twill*, and the *satín* or *sateen*. In the plain weaves, the interlacings are such as are seen in a handkerchief, a piece of burlap, or a piece of sheeting. Into the twill category come all of the diagonal effects. In the satín, the threads are so arranged that the surface of the cloth seemed to be entirely composed of warp threads, the filling appearing only on the back. No matter how complicated the design may be, whether figured or otherwise, its different parts will be worked out from these three weaves.

In the manufacture of **PILE FABRICS**—velvets, plushes, carpets, etc.—the pile, which stands erect on the surface of the cloth, will be made from an extra set of warp threads introduced into the fabric, or from extra filling threads, which interlace across the face of the goods, according to the method of manufacture. These pile threads may be "cut," as in the case of velvets, plushes, Wilton carpets, etc., or they may be "uncut," standing up in the form of loops, as in the case of terry cloths, Brussels carpets, tapestry, carpets, etc.

Knitted fabrics are made principally on circular knitting machines, so that the fabric comes out of the machines in tubular form, and it is then cut up lengthwise so that it can be spread out for cutting up into garments. Some knitted fabrics are, however, woven flat, and not in tubular form.

To attempt to give a special description of each of the multitude of woven and knitted fabrics that are found on the market would be impossible. J. CH.

TEXTILE FINISHING broadly includes BLEACHING, DYEING, PRINTING, and the final processes to which textiles are subjected before they are placed on the market. In its more restricted meaning, where it refers only to the final treatments, finishing embraces a large number of diverse operations which are carried out for the purpose of producing the required appearance and handle of the yarn or fabric.

One of the major operations in finishing cotton piece goods (*see* COTTON MANUFACTURE) is filling or stiffening. In this process the goods are treated with a solution of STARCH, dextrin, gum, or other thickener. To this solution may be added soap, sulphonated oil or fat, or other softeners; fillers, such as magnesium sulphate, gypsum, China clay, and talc, hygroscopic agents; and antiseptics. When fillers are applied only to the back of the cloth, the process is known as back-filling. After the finishing materials have been applied, the cloth is dried, stretched to the proper length and width, and is cooled or conditioned or dampened.

Cotton piece goods are often passed between rollers which press the fabric and cause it to acquire a glazed or other characteristic surface. This operation is known as calendaring. Various types of equipment are used, such as friction calenders, chasing calenders, schreiner calenders, embossing calenders, and blanket finishing machines, depending upon the particular result desired. For finishing linen and some constructions of cotton fabrics a beetling machine, consisting essentially of heavy wooden "fallers" which are caused to hammer the cloth, is employed. Fabrics before shipping are rolled, plaited or folded, labeled, and packaged. Miscellaneous operations in finishing cotton fabrics include breaking, preshrinking, napping, WATERPROOFING, and flame-proofing.

Fabrics consisting wholly or in part of rayon are finished in a similar manner to all cotton goods; those containing acetate yarn are often given treatments known as delustering, wrinkle-proofing, and iron-proofing. Hosiery containing SYNTHETIC FIBERS likewise is treated with various chemicals which tend to reduce the luster.

In finishing of woolens and worsteds, fulling is one of the processes of major importance. In the fulling process the fabrics are subjected alternately to pressure and friction while they are saturated with a concentrated soap solution. This causes a curling, shrinking, and felting of the fibers, and in turn increases the tensile strength and density of the fabric, accompanied by a shrinkage in width and other changes in the physical appearance of the goods.

Scouring is a treatment in warm soap solution for the purpose of removing the oils or other foreign matter which were added to the wool to facilitate SPINNING and WEAVING, as well as accidental impurities acquired during the process of manufacture.

Crabbing is an important process in which worsted fabrics are stretched while being subjected to the action of steam in order to set the fibers in a definite position and thereby prevent distortion of the yarn in subsequent operations.

Removal of vegetable impurities from wool by treating the fabric with sulphuric acid, hydrochloric acid, or aluminum chloride, and subsequently heating, is called carbonizing.

Raising is the process of forming a nap on the surface of the fabric. It is performed either by hand or machinery by brushing or scratching with teazles, wire brushes, or other devices; the operation may be carried out with cloth in either the wet or dry condition. Drying of woolens and worsteds usually is accomplished by running the goods over a tenter frame which stretches them to proper width while they are being subjected to the action of heat. Other operations in finishing include shearing of the surface fibers to the proper length; burling, or removing knots, burrs, and slubs; conditioning; steaming; brushing; singeing; lustering; pressing; shrink-proofing by decatizing or other means; and waterproofing.

Many of the processes used in finishing silk are similar to those employed in cotton finishing. They include stiffening or filling, tentering, calendering, breaking, singeing or gassing, and showerproofing. Scrooping, which enhances the peculiar rustling sound or crunch of silk, consists merely of treating the fabric in dilute solutions of acetic, tartaric, or other inorganic acid.

Finishing of knit goods and hosiery as a rule consists only of drying, stretching, and pressing. Occasionally finishing oils are added to dyebath or applied separately to give an enhanced appearance and handle.

Yarn and thread are finished with the aid of starch, dextrin, oils, and waxes to give the desired weight, handle, and appearance, or to facilitate their use on sewing machines.

W. W. C.

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TEXTILE PRINTING, or block printing, as a handicraft resembles the use of a rubber stamp. The block is made of wood, carved as for a woodcut. This is dipped into a color-paste, pressed firmly on the cloth and struck with a mallet. True hand blocking can always be detected by pin-marks on each corner of the design, by which the continuity of the pattern is ensured. Each color must usually be printed separately and dried before another is used, although by an ingenious device a multicolor pattern may be printed at a single impression. The complete pattern is cut on the block, after which the color-sieve, corresponding to the stamp-pad for a rubber stamp, is arranged in compartments, each with its proper color, so as exactly to match the block pattern. This is called "toby-printing." A basis of starch, flour, gum or albumen is used for the color-paste.

The origin of this art is unknown. The ancient Romans imported India prints and the art existed independently in Europe in the Middle Ages. Rhenish monks developed an extensive trade in block-cutting. Some think that textile printing antedated printing on paper.

Hand-blocking was eventually superseded by roller-

printing, to which machinery was easily applied; it has, however, been revived as a handicraft. A few commercial firms are now specializing in the expensive hand-blocked chintzes, hangings and other luxury fabrics. The dearth of original designers has led one such American firm to send out promotional lecturers to interest art students.

TEXTILE TESTING, the testing of fibers, yarns and fabrics, may be divided into three classes: physical, microscopical and chemical.

Raw fiber testing, cotton and wool, may be limited commercially to grading, staple, moisture content, strength and elasticity. The grading consists of an examination of the fibers in comparison with government standards and placing the lot into its respective class.

All yarns are tested very much alike; cotton, wool, silk and rayons are tested for count (yards per pound), twist per inch, ply, strength and stretch. Spun yarns are also stapled. Strength tests are made by the single strand, skein or multiple end methods on machines provided with an autographic recorder for determining the stretch or elongation. Rayon yarns are also tested for strength and elongation in a wet state to show the loss in strength as compared over the dry or normal state.

Raw silk grading or classification is somewhat different than for other yarns. The classification is based on evenness, neatness and cleanness of the yarn to be graded against photographic standards which have been adopted by the trade and is estimated on a percentage basis, such as 78-82% or 90%. Raw silk is usually bought and sold, in addition to the above grading, on a standard regain basis of 11%. Thrown silks are bought and sold on the same basis with a guaranteed loss in boil-off stipulated in the contract, thus assuring the buyer of receiving exactly what he paid for.

Fabric testing is very much alike for all types of fiber. Samples are analyzed for reed, reed width, pickage, yarn counts, twist, ply, weave, weight and type of fiber. Other tests are tensile strength by one of the two standard methods known as the "Grab Method" and the "Strip Method"; abrasion tests to determine comparative wearing qualities, fastness of dyes to light, washing and perspiration, percentage of loading, kind of loading, and percentage of various fibers chemically or microscopically.

The American Society for Testing Materials, through its Committee on Textiles, has drawn up standard methods of testing, together with numerous specifications for various yarns and fabrics which are being used throughout the trade.

W. F. E.

BIBLIOGRAPHY.—Publications of American Society for Testing Materials.

TEXTUAL CRITICISM, the term used to express the systematic study, comparison and criticism of texts with an end in view to restore them to their original sense and content. The chief fields for textual criticism are the Old and New Testaments, the Greek, Latin and medieval authors, and even many passages

of Shakespeare on which the opinion of experts differ concerning the poet's original wording. Mistakes abound in these old documents because they were copied by hand, and with each successive copy human carelessness and ignorance multiplied the errors which had crept into the preceding copy. By the time five or six successive copies had been made, each copyist adding his own mistakes to those already existing in the preceding copy, the author's original meaning had been greatly obscured and in many cases entirely lost. Omissions on the part of copyists and substitutions of their own invention have also taken the place of the author's words and lines, while insertions, not only faulty in themselves, but written in by the copyists in the wrong places, have sometimes rendered the meaning of the author utterly obscure, as have transpositions of letters, syllables, words and lines. The rectification of such errors involves the study of the available manuscripts of the same work and their comparison with any chance allusions made to the author by contemporary writers and with ancient translations of the work.

THACKERAY, WILLIAM MAKEPEACE (1811-63), English novelist, was born in Calcutta, India, July 18, 1811. At six he was sent to England where he was educated at the Charterhouse and Trinity College, Cambridge, which he left after two years for travel on the Continent. Later he studied law in the Middle Temple but presently turned definitely to a literary and artistic career. For a time he studied art in Paris but, although he had a native talent for caricature and illustrated his own works, his artistic achievement was of slight consequence. From childhood Thackeray had been precocious in writing and drawing, and after he began turning these gifts to account in his early twenties he did much newspaper work, owned and edited a newspaper, wrote sketches under several pen names, published books, was for years an important member of the staff of *Punch* and acquired some reputation as a clever satirist and writer of burlesque. But until his middle thirties he had done almost nothing but good hack and newspaper work. In 1846 he published *Barry Lyndon*, a satirical novel accounted by many critics one of his best works; this, however, attracted little attention. *VANITY FAIR*, brought out in monthly installments in 1846-48, made the author famous, and when it was followed in 1850 by *Pendennis*, Thackeray was acclaimed one of the greatest of living novelists. These and *HENRY ESMOND*, published in 1852, *The New-comers*, 1854, and *THE VIRGINIANS*, 1859, are the most important of his many novels and other works. He lectured very successfully in England and the United States on 18th century English humorists and on "The Four Georges." On the side of his faults must be set Thackeray's exaggeration of both the virtues and vices of certain of his characters, and perhaps also his indulgence in those numerous lengthy asides which he believed gave the charm of intimacy to his novels. As to his virtues, it can be said that the novelist commanded a wide picture of life with urbane

ease, polish and unfailing wit. Thackeray died while at work on *Denis Duval*, a historical novel, at London, Dec. 24, 1863.

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THAÏS, an opera in three acts by JULES MASSENET, libretto based on ANATOLE FRANCE's novel of the same name by Louis Gallet; première, Paris, 1894, New York, 1908. It is one of the most successful of Massenet's operas and holds a permanent place in the standard repertory.

The monk Athanaël (in the novel, Paphnuce) has journeyed to Alexandria. Returning to the monastery he brings back the story of a shameless courtesan, Thaïs, from whose alluring beauty he had turned in his youth to seek holiness. He determines to set her on the paths of virtue. The monk journeys again to Alexandria, proceeding to the home of his friend Nicias who is her present lover. Doffing his habit, he goes to a banquet which Nicias holds in the woman's honor, and calls upon her to renounce the evil of her ways. She laughs at Athanaël, but presently she repents her sins and seeks forgiveness in a convent. No sooner has she done so than the monk who wrought her conversion discovers that he loves her madly. Amorous thoughts fill his heart and overwhelm him. Believing that she is dying, he hastens to the convent where Thaïs has secluded herself. He finds her on the point of death but happily awaiting the pure joys of heaven. He vainly pours out his love in a frenzy, falling stricken by her bedside when the woman whom he converted from an erring life leaves a world of sin.

THALER, formerly, a silver German coin, equivalent to three MARKS or about 71½ cents. It was first issued in the 16th century and was the German monetary unit. In 1871 it was superseded by the mark but it remained in use until 1908.

THALES (c. 636-546 B.C.), Greek philosopher, was born at Miletus in Ionia. He was the first of a long series of Ionian philosophers who, no longer satisfied with the commonly accepted account of the origin of the world and of mankind, sought to find some primary physical element out of which everything in the universe has developed and differentiated. This fundamental element he judged to be water. From water, he maintained, everything has arisen and into water everything is again resolved. A man of wide scientific interests and activity, Thales is reputed to have predicted accurately an eclipse of the sun in the year 585 B.C. Throughout the Greek world his wisdom was proverbial.

THALIA, in classical mythology, one of the nine MUSES, and also one of the THREE GRACES.

THALLIUM, a metallic chemical element (symbol Tl, atomic weight 204.3, sp. gr. 11.85), of the same group as indium and gallium, though in its properties it resembles, at the same time, lead, potassium and mercury. It occurs in nature mostly associated with arsenic and sulphur, and was discovered spectro-

scopically by Crookes in 1861. The metal is very soft, and bluish in color. Its compounds are used to give a high refractive index to glass, and possess the property similar to that of silver compounds, of being sensitive to light.

Medicinally, compounds of thallium are almost as toxic as those of arsenic. Thallous acetate, taken internally, causes falling out of the hair; it has, therefore, been incorporated in certain nostrums for removal of the hair. Because of the use of such nostrums by the laity, many cases of thallium poisoning have been reported.

THALLOPHYTES, one of the four main divisions of the plant world, comprising all the flowerless plants that have no vascular system. Wholly lacking stems, leaves or roots, the plant body of thallophytes is usually a thallus, the most familiar example of which is a seaweed. Besides the **ALGAE**, however, thallophytes include the **FUNGI** and **LICHENS**, some of which are wholly microscopic. Their methods of reproduction vary, but it is usually by spores. N. T.

THALWEG. See **BOUNDARIES**.

THAMES, the principal river of Great Britain and in its lower course one of the leading commercial waterways of the world. In southern England, it flows eastward for 210 mi. from its source in the Cotswold Hills of Gloucestershire to form a great estuary 18 mi. wide as it pours into the North Sea below the Nore. The river is almost wholly navigable; barges can travel to Lechlade near its source and continue along the Thames-Severn Canal, the most important of a number of waterways joining the river with other streams. In its upper reaches, as it winds through a wide, pleasant valley, the Thames receives among its tributaries the Thame, Coln, Cherwell and Leach. Upon reaching Oxford it turns south through a beautiful wooded region. The Thames passes Henley, Eton, Windsor, Kingston and Richmond, cutting east at Reading on its way to London, 60 mi. from the mouth. Below the metropolis are Greenwich, Woolwich and Gravesend. Flowing in at the south are the Medway, Kennet and many very small affluents.

LONDON lies on both banks of the river, which follows a tortuous course through the city, averaging 1,000 ft. in width from bank to bank, is accessible to ocean liners and has 35 mi. of docks to care for the huge amount of shipping at this world port. Here the water is spanned by a number of bridges, and there are two embankments. Since it is the chief source of London's water supply, regulations have been made which strictly govern the disposal of sewage in the river.

The waterway passes on its north banks the counties of Gloucester, Oxford, Buckingham, Middlesex, and Essex; on the south banks are Wiltshire, Berkshire, Surrey and Kent. Floods often inundate the banks during the spring, although at other seasons the flow of water may diminish greatly. Besides its tremendous importance as a trade channel, the Thames is also extensively traversed by motorboats, rowboats

and other pleasure craft, as well as passenger vessels. Commissions and sporting clubs of communities along its banks regulate the catching of fish, in which the waters are rich. From antiquity on, writers have mentioned the river. In *De Bello Gallico* Caesar refers to it as the Tamesis.

THAMES, BATTLE OF THE, Oct. 5, 1813, an engagement of the WAR OF 1812 which resulted in an American victory. Gen. Harrison, commanding the American army in the West, crossed Lake Erie with 4,500 troops. Landing near Malden, he found that Gen. Proctor, commanding the British and Indian allies, had retreated at the prospect of battle. Pursued up the Thames River by the American force and taunted with cowardice by Chief Tecumseh, Proctor made a stand on a tableland between the Thames and a marsh. Col. Johnson's mounted regiment of Kentuckians, ordered to begin the charge, put the British force of about 1,000 to rout. Before the American infantry had gotten into action over 600 of the British were made prisoners, and the rest had fled into the forest where the cavalry could not follow. A column of cavalry, dismounting, engaged Tecumseh's Indians at close quarters; the chief was among those killed. The American loss was about 45.

THANATOS, in Greek mythology, the god of death, the same as the Roman **MORS**. He was son of Nyx and the twin brother of Hypnos or Sleep. Thanatos's abode was in the lower world.

THANET, OCTAVE. See **FRENCH, ALICE**.

THANKSGIVING DAY, annual holiday by proclamation of the President for the District of Columbia and of governors for the various states. The custom was originated by the Pilgrims in 1621 following their first harvest. About 10 years later various colonies occasionally set aside a day for prayer and thanks until in 1680 in the Massachusetts Bay Colony it became a recognized annual holiday. The governors of these colonies appointed the date for thanksgiving and the Continental Congress made provision for the days of thanksgiving annually during the Revolution, with the exception of 1777. In 1789 Washington proclaimed a day for offering thanks and again in 1795. Acting upon a resolution of Congress, President Madison set aside a day for thanks after the War of 1812. In 1817 New York adopted Thanksgiving Day as an annual holiday and was followed in that by many other states, so that in 1858, by proclamations, Thanksgiving Day was observed in 25 States and 2 Territories. In 1864 President Lincoln designated the last Thursday of November for Thanksgiving, as Washington had done, and since that time each President has followed the precedent by an annual proclamation.

THAPSUS, a city of northern Africa. It was located in Byzacium, a part of Africa Propria. Historically the city is important for the battle of Thapsus which was fought here in 46 B.C. The civil war between Caesar and Pompey closed with this battle, leaving Caesar the sole ruler of Rome.

THASOS, an island in the Aegean Sea east of the Gulf of Rendina. Phoenicians were the first colonists and Parians came in 708 B.C. The Thasians became a powerful people and acquired territory in Thrace. They were finally conquered by Athens about the end of the 5th century and in 197 B.C. came under Rome. The Turks took Thasos in 1462 and later gave it to the Khedive of Egypt.

THATCH PALM, the common name for a genus (*Thrinax*) of small palms, native to the tropics of the New World from southern Florida through the West Indies to Central America. There are about eight species, four of which occur in dry coral ridges and sandy shores in southern Florida. All bear large fan-shaped leaves, 2 to 4 ft. across, extensively used for thatch and for making hats, baskets and small cordage. The light, soft wood of the slender trunks, mostly 20 to 30 ft. high, is used for piles in the construction of small wharves.

THAXTER, CELIA (1836-94), American poet, was born at Portsmouth, N.H., June 29, 1836. In 1851 she married Levi Thaxter, a Browning scholar. Many of her poems are of the sea and island shore; they express a deep love of nature and genuine poetic gift. Mrs. Thaxter published several volumes during her lifetime; her *Letters* and her collected poems appeared after her death. Among her finest poems are *The Sandpiper* and *Wild Geese*. She died at the Isles of Shoals, Aug. 26, 1894.

THAYER, ABBOTT HANDERSON (1849-1921), American artist, was born Aug. 12, 1849, at Boston, Mass. He studied under Gérôme at the École des Beaux-Arts, Paris. Thayer then returned to America and became famous as a portrait, animal, landscape and figure painter, and was also known as a naturalist. He was an original member of the Society of American Artists, and was a member of the National Academy of San Luca, Rome. Among his best known works are *Young Women*, in the Metropolitan Museum, New York; *Caritas*, Boston Museum, and *Winged Figure*, in the National Gallery, Washington. In 1884 he executed a mural decoration, *Florence*, for Bowdoin College. Thayer died at Monadnock, N.H., May 29, 1921.

THAYER, WILLIAM ROSCOE (1859-1923), American author, was born in Bedford, Mass., Jan. 16, 1859. He traveled abroad with tutors and was graduated at Harvard in 1881. From 1892-1915 he edited *The Harvard Graduates' Magazine*. From 1918-19 he was president of the American Historical Association, and from 1913 till the year of his death was an overseer of Harvard. Among his published works are *A Short History of Venice*, 1905; *The Life and Times of Cavour*, 1911; *Life and Letters of John Hay*, 1915; *Theodore Roosevelt*, 1919; *The Art of Biography*, 1920, and *George Washington*, 1922. Of all his works the most noteworthy are perhaps those dealing with Italy. Thayer died at Cambridge, Mass., Sept. 7, 1923.

THEATER. A theater is literally a "place for seeing." Therefore the term may be applied to any cen-

tral spot arranged for an action before an audience. In this form the theater has existed since prehistoric times. But the real beginning of the western theater was at the Altar of Dionysus at the Acropolis in Athens. Of this the first architectural feature was a wooden stand on which stood the leader of the chorus. Later this was enlarged to a platform on which the action could take place. At first the audience stood in a circle round the altar. Enlargement of the stage made it necessary to narrow the audience area to the segment of a circle. In early theaters the auditorium was placed against a hill, but later, wooden stands were erected for spectators, and in Roman times these were built on arches. *See also* GREEK DRAMA.

The parts of the early theater were described by Vitruvius, as the Orchestra, which was circular in form, on which the action took place; the Auditorium, occupied by the audience, usually on the side of a hill with seats in circular tiers; the Scena, or tent, in which the dressing was done, and which served as a background for the action. Between the orchestra and the auditorium the altar was placed. Important early theaters are those at the Acropolis, Epidaurus, Megapolis and Delos. Modifications of the Greek theater were made in Roman times to adapt it to larger audiences and to demands for spectacular amusement. Both the Greek and Roman theater had many expedients associated with later stages. Among these were painted scenery, introduced by SOPHOCLES, moving platforms, cranes by which actors representing gods could be suspended above the stage, upper stages and stairs leading from below. The Greeks could imitate thunder and in Roman times curtains were introduced and night performances were illumined by flares. Certain small Roman theaters were covered. The Romans also introduced scenery for various types of action, columned façades for tragic plays, private houses for realistic comedies, and rustic scenes. *See also* ROMAN DRAMA.

With the collapse of Roman civilization the building of theaters ceased for a thousand years. In the Middle Ages performances were held in churches, on platforms and wagons in the streets and in court-yards, and in the drawing rooms of palaces. In France the first theaters were in enclosed tennis courts. *See also* MEDIEVAL DRAMA.

The era of modern theater building begins in the 16th and 17th centuries under the influence first of the classic stage which was introduced with the Renaissance, and second, of the rise of popular companies, the managers of which erected places of amusement modified from the plans of the inn yard stages. Naturally these led to entirely different types of theaters. To the first class belong the Teatro Olimpico at Vincenza, Italy, built in 1580, a Roman theater roofed over, with an auditorium, half-orchestra and architectural back-structure. To the second class belongs the first theater erected in London, THE THEATER, built in Shoreditch in 1576-77. Both of these types promptly disappeared, leaving only a few

traces of their characteristic design on the modern theater.

The theater of to-day is an outgrowth of the ball-room theaters employed in Italy, Paris and London for the presentation of court MASQUES and spectacles. Until the present theater architecture has been dominated by the spectacular and aristocratic demands laid upon it in the 17th century. Out of the demands of the spectacle developed the raised stage, the proscenium arch or frame, the system of high lighting by footlights and borders, of perspective and spectacular scenery. Out of the demands of caste derived the horseshoe arrangement of boxes, the artificial divisions in the seatings of classes. The first modern theater is the Teatro Farnese, Parma, 1619, with auditorium and picture stage. But the proscenium arch had been used in England as early as 1607. Painted perspective scenery was introduced into England by INIGO JONES. And at the Restoration CHRISTOPHER WREN introduced the inclined stage, wings, arch and boxes from Italy. Naturally the different types of theaters reflected different orders of production. The platform stage of Elizabeth's time was used for declamatory actions, and the staging was plastic. The Restoration stage saw the beginning of costly trappings, and the rise of the scene painter. As changes of scene had

come about through the adaptation of the Restoration type of theater to the more democratic and realistic purposes of later times. Little has been done to break with this tradition, though stimulating suggestions have been made. Probably the chief changes have taken place under the following heads. 1. Changes in the auditorium have come in response to democratic tendencies. The architectural revolt was led by RICHARD WAGNER in his Bayreuth *Festspielhaus* which did away with differentiation in seating and erected one bank of seats in wedge shape. 2. Changes in principles of staging were concerned largely with a revolution in the principles of stage lighting, with a discarding of the picture frame stage and of perspective scenery, and with the introduction of masses, design and stylization into the production. 3. Changes in the principles of rapport between audience and play raise some of the most interesting questions of the modern theater. On the one side is Wagner's theory of the "mystic abyss" between the audience and the player. On the other side are the theories of MAX REINHARDT, Norman Bel Geddes and others who would destroy the barrier between audience and play, connect the two worlds by a bridge of disillusion, or would set the stage in the midst of the audience after the manner of the circus. The recent advent of the motion picture theater has had little influence on theater design. It retains the arch as a frame for the picture, simplifies seating arrangements, and in many cases does away with the stage entirely.

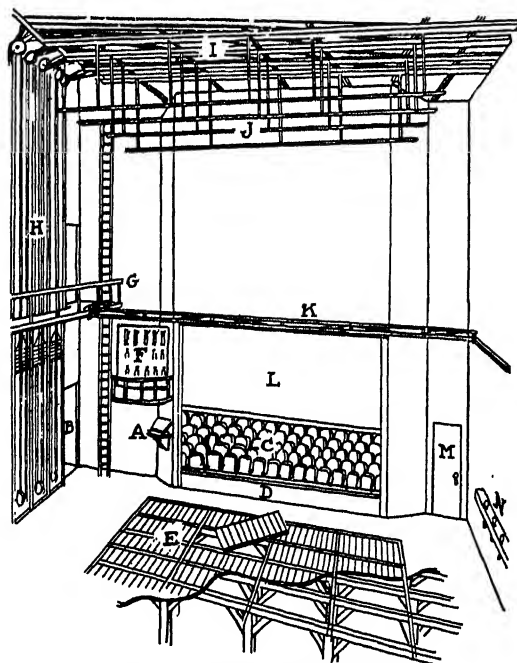
Among modern architects and designers who have contributed to the theory of the theater are Semper, architect of Wagner's Bayreuth theater, Adolphe Appia, Max Littmann, Oskar Kaufmann, Georg Fuchs, GORDON CRAIG, Josef Urban and Norman Bel Geddes. See also STAGE SCENERY; STAGE LIGHTING.

T. H. D.

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THEATER BUSINESS, LEGITIMATE, in the United States. The legitimate theater in the United States has a history commencing early in the 18th century. Since then its business structure has developed from small, self-sufficing, decentralized units of permanent companies of strolling players into a highly centralized, interdependent, national system largely dominated by theater circuits and booking offices with headquarters in New York City. The business is made up of several allied enterprises brought into relationship through the activities of a producer.

There is the business of theater ownership and management. Although the theater owner may also be a producer, he has usually no more to do with the play in his house than has the owner of an office building with the affairs of his tenants. He merely puts his theater at the disposal of a producer, generally on what are known as "sharing terms"—the division of receipts and of certain expenses on some



A USEFUL STAGE ARRANGEMENT
 A—Prompter's table F—Switchboard K—Sliding bridge
 B—Dressing rooms G—Fly gallery L—Fire
 C—Auditorium H—Counterweights
 D—Orchestra pit I—Gridiron
 E—Stage floor J—Permanent battens N—Belaying pin rail

FROM A. E. KROWS, EQUIPMENT FOR STAGE PRODUCTION, D. APPLETON & CO.

to be accomplished on the stage, and not in the minds of the audience, the plays tended more toward the unities. See DRAMATIC UNITIES.

In general the modern changes in the theater have

agreed basis. There are a series of businesses whose function it is to supply the equipment required for play production—scenery, properties, lights and costumes. There are play-brokers, actors' agencies, transfer companies, ticket brokers and other enterprises.

It is through ticket brokers that the law of supply and demand manifests itself. An overwhelming proportion of plays begin and end their runs without changes in the box office scale of prices. At the most there may be one or two changes. The actual market price which the public pays, however, may be anywhere from one-half to twice the advertised scale. Tickets for the less popular productions, and for the poorer locations for many of the more popular ones, are offered by the "cut-rate" agencies at large concessions, while those for successes and hits, and for the best seats for virtually all plays, are sold in large proportion by premium-charging agencies which get their supply from the management on an allotment basis. In New York City the premium brokers are an exceedingly important factor in the theater business, often directly or indirectly supplying capital for a production and, by their subsequent efforts in distributing tickets, contributing largely to the financial success of the enterprise. They are of a lesser degree of importance in a few other large cities, but are virtually non-existent in the smaller communities.

One comes now to the business of the producer himself, which consists of fashioning a written play into a stage production. The first step in this process is to obtain a suitable playscript. Having found one, the producer pays the author a flat sum for an option to produce it within a fixed period of time and agrees to pay him, upon production, a percentage of the gross receipts of the play, known as a royalty.

The next step is to engage and rehearse a cast. This the producer may do himself, but more frequently he engages a stage director for this purpose. Actors are employed under one of several standard contracts issued by the Actors' Equity Association, the union having jurisdiction over virtually all the legitimate actors of the country. These contracts cover all conditions of employment, but do not stipulate salaries, which are left to free individual bargaining, except in the case of chorus members for whom there is a minimum weekly scale. Occasionally a featured actor, or "star," receives a small percentage of the weekly gross receipts of the production in addition to his contract salary.

By the time the cast is in rehearsal the producer's press representative starts his publicity and advertising campaign which continues with a varying degree of intensity throughout the run of the play. Publicity consists of news items, including photographs and drawings, about the play, the players, the dramatist, the scenery and the producer which appear in the daily and Sunday papers and in magazines. Every incident in any way connected with any phase of the production is used by the press-representative as an opportunity to get the name of the play before the reading public. Paid advertising consists primarily

of short daily notices on the dramatic pages of the newspapers and in a few weekly, and even fewer monthly, periodicals. Next in importance come billboard displays. Window displays are less popular than formerly, though still employed extensively on the road. Direct mail solicitation is also losing favor. A comparatively new and still undeveloped medium of advertising is the radio. Much money goes into publicity and advertising, the cost generally being divided between producer and theater owner in accordance with the term of the sharing contract.

While the play is in rehearsal and while necessary changes in the script are being made, the various purveyors of equipment assemble the scenery, properties and lights which the producer has ordered. In charge of this work is the art director, either a "free-lance" employed directly by the producer, or one on the staff of the scenic studio which paints the sets.

When the equipment has been assembled and the actors rehearsed, the play is ready. But prior to the opening in the city in which it is destined to have its run, it often goes on a short try-out tour in neighboring communities to afford an opportunity for ironing out the rough spots which become manifest only through the reactions of audiences.

After the try-out, the play settles down for a run in the theater which the producer has contracted to occupy. The length of the run is determined only by the box office receipts in relation to weekly expenses. When the play no longer shows a sufficient profit it is closed, but may subsequently tour the country, "go on the road," as it is called.

"The road," which really means every town and city outside of New York, has steadily declined in importance during the last two decades. The competition of the motion pictures is held chiefly responsible. To make up for at least a part of this important loss of income the author and producer receive money for various "rights"—primarily motion pictures rights.

Whether the play closes after its initial run or goes on the road, its career eventually ends. Actors are dispersed and scenery is sold or stored. The producer may continue, but his next production is an entirely separate enterprise.

This brief description of the business of play production covers only the normal procedure, from which the individual producer's methods may vary at every step. Furthermore, it applies only to what is termed the "first-class legitimate theater"—the production of separate plays for extended runs. Other branches of the legitimate theater, operating under different systems, include stock and repertoire companies, tent shows and show boats, tabloids and the entire field of amateur theatricals.

A. L. B.

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THEATER LEGISLATION. The Federal government exercises no supervision of the theater in the United States. Such legislation as deals with the

THEATRICAL COSTUME DESIGN



4, 5. COURTESY THEATRICAL COLLECTION, HARVARD COLLEGE LIBRARY

THEATRICAL COSTUME DESIGN: CLASSICAL, MEDIEVAL, ELIZABETHAN AND MODERN

1. Greek tragic actor in full costume, wearing the *embâtes*, or high-soled shoes. 2. Mystery play performers enacting a scene of the martyrdom of St. Appolonia. 15th century. 3. Polichinello, a classic character of French puppet shows. 4. François Joseph Talma (1763-1826), the celebrated

French tragic actor, as Nero in Racine's *Britannicus*. 5. Fanny Kemble (1809-93), English-American actress, as Juliet, and Mary Ann Davenport (1765?-1843), as the Nurse in Shakespeare's *Romeo and Juliet*. 6. Drawing by Leon Bakst (1886-1924) for the ballet, *Narcisse*.

theater, either as an institution or as an individual playhouse is exercised by the several states or by individual communities in those states.

That legislation is primarily concerned with requiring the theater to pay its share of the expense of running the community, through taxation, or requiring a license to be procured; or it is an exercise of the police power of the community which is concerned with safeguarding the health and safety of theater patrons, with seeing that the plays produced do not depart too far from the general standard of the conscience of that community, and with the maintenance of decency and order in the theater itself.

Practically all states and communities in which the theater is present require such taxes and licenses as will cause the theater to pay a proportional part of the community budget.

In general all states and communities also exercise a certain amount of police control over theaters. But the amount of control and the strictness and impartiality of its exercise vary greatly in different communities and even in the same community at different times. See CENSORSHIP.

All, or nearly all, communities have laws requiring the inclusion of certain factors of safety in the construction and maintenance of theaters; with a limitation of the number of persons who may be admitted at any time; and with the provision of minimum sanitary arrangements.

And all, or nearly all, communities forbid immoral, indecent and obscene presentations, though comparatively few are able to reach a definite conclusion as to just what falls within or without those categories.

Individual states or communities have laws regulating the conditions on which children may appear on the stage, or prohibiting their appearance under any conditions; others forbid the opening of theaters, or certain kinds of theaters, on Sunday, but these are matters which each community or commonwealth decides for itself.

Occasional commonwealths or communities attempt from time to time to legislate in the interests of one form of entertainment against others. For instance, in a few states, mostly in the South and Southwest, conditions are made so onerous for traveling tent dramatic attractions that they cannot successfully play in their jurisdiction. This legislation, whether generally so recognized or not, is often in the interests of motion picture competitors of the tent shows.

By far the most powerful factors in the regulation of working conditions in the theater are the trade agreements worked out for the governance of the theater by the various groups of employers and employees in the theater. Between them the real legislation under which the theater is governed is worked out, and by them it is administered. F. G.

BIBLIOGRAPHY.—Frolich and Schwartz, *The Law of Motion Pictures and the Theatre*; S. H. Wandell, *The Law of the Theatre*; J. A. Brackett, *Theatrical Law*.

THEATER OF WAR, the entire area of land and sea which is or which may become involved in the

operations of a war. That part of the theater of war involved in immediate operations is divided into the zones of the interior, i.e., the home territories of belligerents, and theaters of operations, where the field forces carry on the war.

THEATER SCHOOLS. Since the theater as an art uses life and the problems of men as its subject the best school of the theater is life itself. But the work of the playwright, the actor and the craftsman must make its bid for emotional effect and this, in exact replica of life, it would be unlikely to achieve, and therefore exaggeration either slight or ample must be resorted to. It is this that must be learned together with a way to exhibit outward show of inward feeling.

The modern theater school is a recent development. Until 40 or 50 years ago nothing could be learned of the theater except by being part of it. While the playwright, the actor and the craftsman in the theater have to work with a definite technique, only in the hands of a talented person is a well-established technique of any great value. The intangible thing called talent, which must be a gift of nature, is the first essential for anyone going into the theater. A talented person will most readily learn by direct observation. A good school of the theater will give him a well-ordered schedule in which he may observe and find out by way of a well-ordered curriculum what attributes are essential for the work in the theater. But the first requisite, talent, must be innate to give the influence of the school on the student much value.

The old custom, and one which is still in vogue where the theater is most vital, is the apprentice system in force in Continental theaters. Here the student is admitted for a probationary period without pay in a working institution where various plays are continually being presented. In France there is a national conservatory where a student may definitely qualify in certain requirements and where he is eventually given his opportunity to practice his art before the public. The public has always been, is now and always will be the final arbiter of the success or failure of anyone working in the theater. The French conservatory merely prepares a student to go before his jury, the public, with the knowledge of how and why those who have appeared before him have achieved success. It thus saves the public the unpleasantness of seeing an untalented and untrained person exploited and it is likely to discourage all but the best-equipped students from entering the theater. The Royal Academy of Dramatic Art in London is an institution similar to that of the National Conservatory in France except that it is a private enterprise. Everywhere on the Continent the spoken drama is recognized and fostered by national governments. Not so in England. As the theater gains by national recognition so does also the school of the theater, and it then follows that the graduated students in the Continental schools of the theater achieve more recognition than do students of the English or American schools where the teaching is in the hands of private institutions.

In America the National Academy of Dramatic Art, a private institution, has been in existence since 1884. For many years it was the only school of the theater that had any recognition; practically every person who contemplated becoming an actor or an actress felt obliged to spend two years at this school. About 1915 a new wave of public interest in the mechanics of the theater manifested itself and with it came the announcement of new schools exploiting the new methods of stagecraft and acting. Harvard University, where Prof. Baker had already been teaching playwriting since 1905, in 1912 combined a workshop with the playwriting class, where any efforts of the students would be tried out. Later Harvard University abandoned this work and Yale University offered the opportunity for Prof. Baker to continue his guidance for young playwrights.

In Pittsburgh, 1914, the Carnegie Institute, through its Department of Fine Arts, established a school with emphasis on the mechanical side of the theater. Taking their inspiration from these three pioneer adventurers, practically every university and college of standing in the country to-day has a department of drama production. A significant development in 1918 was the inauguration under the direction of Prof. Frederick Koch at the University of North Carolina of a drama workshop to stimulate interest in the writing and producing of Folk-Dramas indigenous to the people of that state.

The latest developments in the institution of the study of the theater are the summer sessions that are intended for people who are unable to devote their entire time, or too busy to give any time during the winter season, to acquiring knowledge of theater production. Many of the universities who have full winter courses have abridged summer sessions. In 1931 there was only one school independently organized with a complete faculty for all branches of theater production including playwriting—the Manhattan Theater Colony which was organized in 1926 and which established itself adjoining the MacDowell Colony at Peterboro, N.H., but was later removed to Bristol, Conn.

Individual teachers of one or more departments of the theater may be found in large centers such as New York, Chicago, Boston, Philadelphia, San Francisco and St. Louis, but the work of the theater either as an art or as a technique is best learned where practical contact with all of its phases can be encountered. It is too wide in its scope to avail the student much by training in one department only. A general knowledge of the whole activity is necessary for an intelligent practice of any special phase of it. A playwright should know something of acting and craftsmanship; the actor should know something of playwriting and craftsmanship and the craftsman is at a great advantage if he understands the problems of the playwright and actor. *See also EDUCATIONAL DRAMATICS.*

W. H.

BIBLIOGRAPHY.—K. Macgowan, *Footlights Across America*, 1929.

THEATRE, THE, the first theater in England, built by James Burbage in 1576, on ground formerly within the precincts of Holywell Priory, in Curtain Road, Shoreditch, London. The Theatre was torn down by Burbage's sons, Richard and Cuthbert, Dec. 28, 1598, and the materials used to erect **THE GLOBE**. It is believed that Marlowe's *Dr. Faustus* was first produced at The Theatre.

THEATRICAL COSTUME DESIGN. The stage costumes and masks worn by both tragic and comic actors of classical antiquity were almost entirely a matter of the strictest convention. The masks were particularly so, consisting entirely of stock types for each of the 28 characters of the ancient drama and so designed as to be readily identified by the spectator. If the character represented a deity or a legendary person he would carry the familiar attribute of that particular deity or person, as Athena with her aegis, or Mercury with his caduceus. In **COMEDY** the conventions were somewhat less strictly adhered to; caricature in the nature of grotesque masks and absurd and elaborate padding worn beneath the costume was a characteristic feature. The chorus costume of **TRAGEDY** was usually contemporary dress, while that of comedy and satire varied in character and usually reflected the spirit of the play. The latter were particularly elaborate, often being representations of grotesque birds and beasts. Roman theatrical costume was a direct imitation of the Greek with the sole exception that plays of Roman subject were acted in ordinary Roman dress. Masks were invariably worn by the Romans down to the Empire, but after that time they were not always used. The mimes of the late Roman period wore masks with closed mouths.

Historic accuracy and archeological minuteness in costume were a matter of complete indifference to the producers of the medieval drama. The **Miracle** and **MYSTERY PLAYS** were performed in contemporary costumes for the most part, probably because the uneducated masses knew nothing of the costumes of other times and places. This same rule was followed by medieval sculptors and the painters of church windows. Church costumes were lent by the clergy, while royal or other expensive types of costume were lent or given by the local nobility and gentry. All heathens were conventionally represented as wearing a turban, oriental trousers and carrying a scimitar. The deity and other divine and near divine persons were distinguished by gilt hair and beards. Saints bore the attributes of their martyrdom or whatever other symbol they were known by. Lost souls wore black garments; pure souls wore white. Devils wore all-over skin-tight garments of wolf or calf skins, with tail and claw-feet or cloven hoofs and head masks of animals equipped with horns. Adam and Eve sometimes appeared nude but often dressed in contemporary peasant costume. Great attention was given to the costume of Morality plays (*see MORALITIES*) wherein color played an important part; Faith wore white, Hope wore violet, etc., while Inspiration wore the dress of an angel.

The costume of the *Commedia dell' Arte* (consult P. L. Duchartre, *The Italian Comedy*, 1929), probably derived from the ancient Greek phallophores, was preserved but with frequent minor alterations by the comedy mimes and buffons down to the early 17th century. Pulcinella's club and Harlequin's bat are probably modifications of the curved staff of the peasants of the ancient Greek comedy. The use of the mask and nightcap preserved the tradition of the shaven heads of the ancient mimes. During the 17th and 18th centuries, the golden days of the harlequinade, the costumes of the various characters underwent frequent alterations and minor additions, but managed to retain their main character.

The lack of stage scenery in Shakespeare's theater was counter-balanced by a magnificent display of apparel which did not differ in cut from the contemporary costume of the day. Historical accuracy was entirely disregarded. Without exception, all plays were acted in contemporary dress. In rare instances, a fantastic costume representative of a foreign country might be used, such as the introduction of a Turk or a Mohammedan who would probably wear a turban and a scimitar in addition to his contemporary dress. Such costumes are recorded in tapestries of the period. Large sums of money were spent on costumes which were defrayed by the actors except in the case of supers. Actors frequently received gifts of slightly worn costumes from the nobility.

Generally speaking, from the 16th century to the 19th, actors usually appeared in the fashions of their day or in a kind of fancy dress largely based thereon. Such fancy dress adaptations were vague attempts on the part of the actor to suggest historical costume, a subject of which he seems to have known nothing. For tragedy, in all plays of whatever period, actresses generally wore contemporary court dress. In the 18th century this was particularly elaborate and consisted of a gown with huge paniers and quantities of trimmings, ribbons and fringes; this was worn with an elaborate headdress or hairdressing composed of a large quantity of feathers and diamonds. Side by side with these, the chief actor wore a "hero" costume which became a convention for all such parts. It consisted mainly of an elaborate gilt armor for the main trunk and a knee-length skirt adorned with gold fringe, wide silk sleeves and a shirt with lace ruffs; a fringed sword belt, fringed gloves and especially an elaborate feather headdress (its main feature) worn over a full-bottomed wig. The middle and latter part of the 18th century saw all of this changed. In England, DAVID GARRICK wore ordinary contemporary dress. Hamlet and Romeo were played by him in white powdered wig and knee breeches. The actresses of his day followed his lead in this respect, that is to say, they wore contemporary costume. During the Directory, Talma attempted an innovation of classic Roman costume, much to the consternation of his fellow actors and audiences.

During the 19th century various advances were made toward historical correctness; CHARLES KEAN

(1811-68) and the Wagnerian productions at Bayreuth were prominent among the innovators. But at best, their efforts were largely a kind of fancy dress reflecting the contemporary costumes of their day. In England, HENRY IRVING (1838-1905) probably came nearer to the real thing than his contemporaries.

The revolution in modern stagecraft that began about 1900 naturally focussed attention on stage costumes as well as upon stage settings. The better designers of scenery nowadays usually design or at least supervise the costumes of a production in order to bring proper harmony between the two. The fanciful and colorful costumes of LEON BAKST (1866-1925) are as well known as the scenic designs of GORDON CRAIG. Modern designers in the theater aim to bring color harmony between the stage setting and its furniture and costume, all of these things being considered as a definite part of a color scheme and a composition. Most of them keep a reference library of historic costume, and a serious attempt has been made to do away with the abuses of convention which seem to have been prevalent in the theater since its inception.

W. T.

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THEBES, 1. An ancient city of Upper Egypt, where Karnak and Luxor now stand, founded at a period too remote for dating. In very early times it was possibly the capital of the country. The expulsion of the Hyksos invaders and the rise of the great 18th dynasty of pharaohs introduced its period of prosperity, extending roughly from 1600 to 800 B.C. It was the center of trade from inner Libya, Ethiopia and Arabia until the foundation of Alexandria, 333 B.C., and long remained the symbol of an isolated Egypt, the stronghold of her religion and conservatism. It lingered until the 4th century A.D.; but the Christians of the Thebaid and finally the Saracens completed its destruction. 2. A Greek city in Boeotia, also of great antiquity, founded according to legend by the Phoenician, or possibly Cretan, Cadmus. In historical times it was the head of a Boeotian Confederation of a dozen cities, and the enemy of Athens. This fact might have induced Thebes to side with Persia in 480 B.C.; it certainly was evidenced during the PELOPONNESIAN WAR, when she demanded the complete destruction of her rival. Thebes eventually became one of the leading cities of Greece, and at Leuctra, 371 B.C., astounded the Greek world by crushing the Spartans. Her leader, Epaminondas, organized an army which Philip II of Macedonia, then a guest of Thebes, afterwards imitated. Philip's attack on Greece at length united Thebes with Athens on the fatal field of Chæronæa, 338 B.C. Three years after, Alexander leveled the city to the ground. A later city built on its site suffered the common calamities of Greece, but in the 11th century A.D. it flourished as a silk center.

THECLA, ST., pupil of St. Paul and missionary, saint of the Early Church, was born in the 1st century and was converted by St. Paul while he was preaching in Iconium, Lycaonia. Many miracles are attributed to her and she is known as "protomartyr" in the Latin Church. Her cult was widely observed in Seleucia, Isauria, although little was known of her actual life. Her day is celebrated on Sept. 23.

THE DALLES, a city of northern Oregon and the county seat of Wasco County. It is situated at the portal of the gorge of the Columbia River, about 90 mi. east of Portland on the Columbia River highway. Near the city are the picturesque Celilo Falls where a great dam and hydroelectric power plant have been established. The city, which is served by two railroads and by steamer, motor bus and air lines, is the trade center for an agricultural, livestock and fruit growing region. Among the local manufactures are flour, planing-mill products, canned salmon and canned fruits. The Dalles was settled in 1847 and incorporated in 1852. Pop. 1920, 5,807; 1930, 5,883.

THEISM. A definition of theism may be given most clearly through a comparison with contrasting theories of God. **DEISM** is distinguished by its belief in a God, who, while the creator of the world, is opposed to his creation. It lays stress on the distinction between natural and supernatural and conceives of God occasionally breaking through the natural order to accomplish his purposes by miracle. God is ever transcendent. The opposite of the deistic concept of God is the pantheistic (*see* **PANTHEISM**), which holds that God is immanent in nature. In the pantheistic conception the whole universe taken together comprises God. All activity and all existence is not only a manifestation of the Divine life and will, it is the Divine life.

Theism occupies the conciliatory position between these points of view. It holds that immanence and transcendence are not incompatible but belong together; that they are the essential elements of personality. For example, a painter may be said to be immanent in his work since it mirrors his technique, his early education, his outlook on life, his conception of color, his ideals and dreams in such fashion as to be distinctly his work which no one can successfully copy: a collection of his paintings, however, is not the artist. Though his pictures are the manifestation of himself they are not the whole of him. He can proceed to many more and varied creations. In an analogous sense the theist holds that God can be both immanent in his creation and transcendent over it. This is what the theist means when he ascribes personality to the divine being.

The modern opposite of theism is the naturalistic concept of God as the purely subjective product of the human mind, a concept expressed in such phrases

as "Man makes his own God." Theism holds that God is the very ground of all nature; the so-called force within the atom, the activity of which is held by modern physics to be the source of the objective world. The theist contends that this force is intelligent and self-directive. As it grounds both nature and man, nature and mind are complementary and our knowledge of the world is validated. The world is intelligible to us because it was made for intelligence and both it and we sprang from the same intelligent source. Thus reality is not in the Spenserian sense ultimately unknowable. In all true knowledge the theist holds that we know reality as it is.

Instead of believing with the deists that miracles are rare in the sense that they are the occasional manifestations of God in the world order, the theist would assert that in the sense of dependence upon a Supreme Will, God's manifestations are the common and continuous process of the world. In opposition to the naturalistic claim that miracle is impossible, the theist holds that, since dependent upon a supreme intelligence, all life and being are in that sense miraculous. In relation to religion it is the contention of theism that supreme devotion to God is the natural way of life and that which best accords with universal being. He who lives most truly in unison with nature will thus be found most truly in unison with the Divine. If it be objected that theism leaves no place for the supernaturalism of religion it can be replied that theism provides the only rational ground for a complete and intelligible supernaturalism by removing the conflict between nature and the supernatural. Likewise it affords a conciliating position for modern science if it continues its present movement toward a view that holds the universe to be fundamentally intelligent and purposive.

R. T. F.

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THEISS, Tisza, a central European river, the largest tributary of the Danube. Draining an area of 56,600 sq. mi. in Czechoslovakia, Hungary, Rumania and Yugoslavia, it is navigable for more than half of its 800-mi. course. The river rises in the Carpathian Mountains of eastern Czechoslovakia, flows in a general easterly direction past Tokay, and turning southward, parallels the Danube on its way through the eastern plain of Hungary, joining that river 30 mi. above Belgrade. Situated on its banks are Szolnok and Szeged, where steamboat navigation begins. Its principal affluents are the Maros and the Szamos rivers. Floods are frequent, though canals and dikes have improved the river-bed. The quantity and quality of the Theiss's fish are celebrated.

